# POPULAR SCIENCE

JANUARY · 35c

## Annual New Car Section

**Plus All Regular Features**

**Facts & Figures:** Specs on all '59 cars

**Safety:** An expert rates the new models

**Opinion Poll:** How your neighbors like 'em

**Engineering:** Detroit faces up to brake problems

## Sizing Up the New Wagons

Ford

Plymouth

Chevrolet

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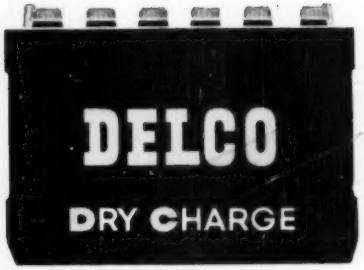


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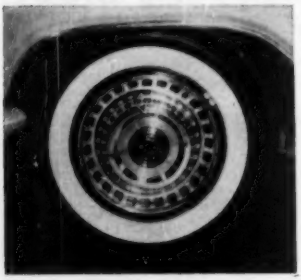
# Popular Science Monthly

**January, 1959**
*Cover photograph by W. W. Morris*



*Inside report: What engineers are doing to put more STOP in today's bigger, faster cars.*

*This work-hungry giant can move a small mountain of earth. Here's what it's like to drive it.*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*Can you get hi-fi from the new mechanical music-makers? Here's an expert's answer, simple tests to make yourself—and specs.*

*Now . . . new headlamps for older, two-eyed cars peer far down the road. Installation? Screw 'em on.*


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# PS Readers TALK BACK

### Plug from a Pro

"ARE You Wasting Money on Premium Gas?" [Oct.] was excellent. So often articles of this nature contain misinformation. In your article, every statement is well founded and accurate, and the subject is one on which there is widespread misunderstanding among the motoring public.

We in the petroleum industry are all too prone to complain about inaccuracies in published articles and we feel it only fair to compliment you and Mr. Luckett on an excellent job.

K. C. BAKER, Pres.,
J. D. Streett & Co., Inc., St. Louis.

### Straight Talks Gave Straight Dope

AFTER reading your "Straight Talks to Parents" series, my engineer husband took your advice and gave our high-school son copies of two books, *You Can Win a Scholarship* and *How to Prepare for College Entrance Exams.* And are we glad we did!

In spite of a woefully inadequate science and math program at our local high school, our boy won substantial scholarships at each school at which he applied, including M.I.T. and Caltech. At present he is at Rensselaer Polytech. He got 800 of 800 points in the college-entrance math exams. Had it not been for your article on scholarships, we might never have bought those books.

MRS. GLENN NOE, Ada, Ohio.

### New Zealander Takes Tip

THE seven tip-offs for rating driver attitude ["How to Defend Yourself on the Highway," Sept.] mentions a pamphlet for law-enforcement officials. As Chief Traffic Officer of Northland for the New Zealand Transport Department, I'd like to have a copy of this pamphlet.

We are fortunate here. Although our number of cars per population rates high, by a constant campaign against accidents we manage to keep them down. But we are always looking for ways and means to reduce them still further.

C. C. DAVENPORT,
Whangarei, Northland, N.Z.

*The booklet is on its way. It's the U.S. Treasury Department Publication 403,* Pursuit Driving. *Others interested can purchase it from the Superintendent of Documents, Government Printing Office, Washington 25, D.C., for 15 cents.*

### This Little Phone Went to Market

AS PART of a picture-news story in November you show a one-piece telephone and indicate that it was covered before in your December '56 issue. But it has a more interesting PS history than that.

After a look-see through some back issues I found a drawing of it when it was reported in "New Ideas from the Inventors" [Nov., '47] as a Swedish invention. One of my hobbies is watching to see how many of these inventions really get to market.

B. MORRISON, Brooklyn.

### Cheers for Electric Heat

I HOPE there are no plans afoot to make changes in your magazine. It is difficult to see how it could be better.

My wife and I built our own house, although we had no carpentry experience. After reading about electric heating in POPULAR SCIENCE, we decided to heat our house that way and skip a chimney—I'm no good at masonry work. The local

Popular Science Publishing Co., Inc., Godfrey Hammond, Chairman of the lar Science Monthly, 355 Lexington Avenue, New York 17, N. Y.



*This story actually happened. (The man's name has been changed and this is not his photograph, but the facts are true.*

## "Your name is on the list"

Doug Mott was not surprised. The recession was on and the assembly line where he worked was almost at a standstill.

And then, strangely, the boss began to smile. "You know how the Engineering Department sends us blueprints and then we have to send them back for revision because they just aren't practical to produce?" Doug nodded . . . wondering. "That's waste . . . and we can't allow it to continue. That's why we thought that if we had a man who knew assembly and production — and drafting, too — he could act as liaison man between engineering and production. You know production, Doug . . . and you're studying drafting with I.C.S. You've got a *new* job. Congratulations!"

Doug Mott now heads a drafting room. But he will never forget the day his name was on the list to be laid off.

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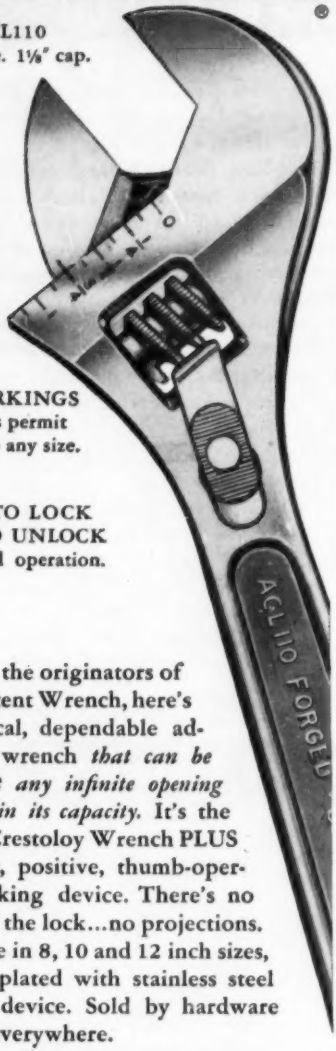


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power company tried to discourage us, but we went ahead and we're perfectly satisfied with our home and the electric heat.

M. E. MARMOR, Bloomington, Ill.

### Defining the K Factor

AS THE owner of a home on a high and windy hill, I read your article on insulation [Oct.] because it held promise of tips for confining those costly and illusive BTUs. It was well written, although an important element was omitted in your definition of the k factor.

The k factor is a measure of the number of BTUs that one inch of thickness will pass per square foot per degree F. of temperature differential between the surfaces, during one hour. Unless a consideration of existing temperature differential is included, the k factor would have no significance. Heat won't migrate unless such a differential exists.

J. G. HAYMES Jr., Derby, Conn.

*Temperature differential must be considered to make quantitative measurements. But you don't need such measurements to use k factor in shopping comparisons of insulation.*

### Uranium Scarcity Ended in '52

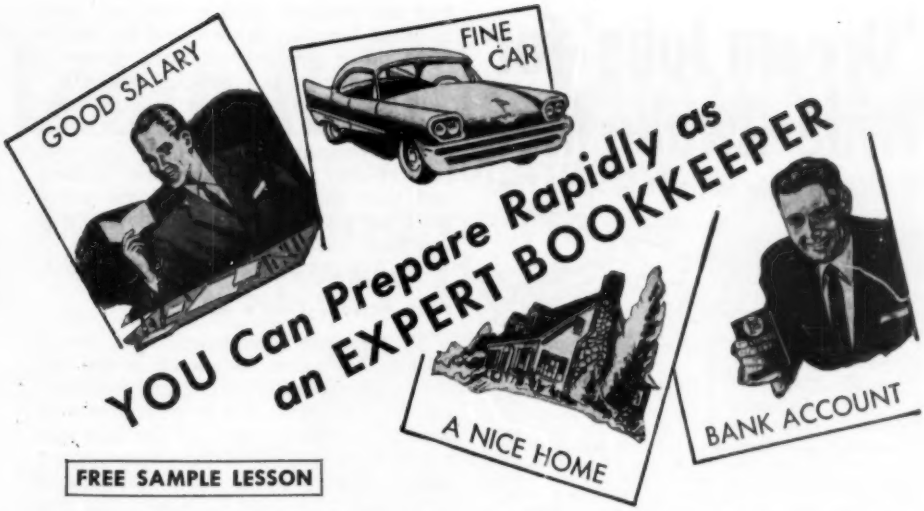
YOUR article, "The Most Fantastic Atom-Smasher" [Nov.], says that the AEC authorized the A-12 plutonium plant in 1950 and canceled it in 1952; and that the cancellation was the result of improvements in the uranium supply in 1950, which included Charles Steen's big Utah strike. Wasn't that in 1952?

LAURENCE WEATHERBY, NYC.

*Yes. The AEC should have been quoted as saying that the cancellation was due to improved uranium supply in 1952.*

### Short Cut for Long Cuts

WHEN marking lumber for a cut beyond the length of your rule, says Nils Mockler ["Short Cuts," Oct.], identify the six-foot mark with a distinct "6." Well, this might keep you from mistaking the cut

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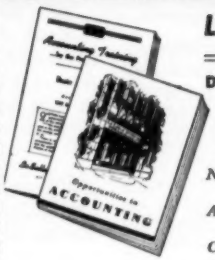


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line and perhaps ruining your last piece of wood, but that figure would be hard to sand off if you are planning to put a finish on the wood.

As a carpenter, I know a better way: On lengths just a little over six feet, mark the shorter measurement first. To cut a piece 6′ 11″, you'd mark off the 11″ first, and then the 6′. That way, the pencil lines are six feet apart and couldn't be confused easily.

WALTER MARYNOW, Livonia, Mich.

### Fast Action, That's All

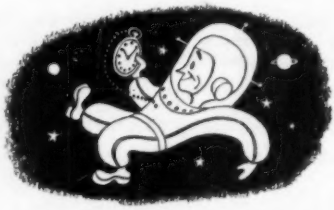
ON THE new highway in and out of Fulton, N.Y., just completed in the fall, they're using spring-based signs on divider islands. Evidently this is an experiment, since of the dozen signs on the west side half are spring-loaded, the others regular posts. Three spring signs have been broken off, while one fixed post has been bent.

Thought this might interest your reader who said he'd "like to see them make" [Oct.] a semiflexible sign.

R. H. FERRIS, Hannibal, N.Y.

### The Split Second

WHEN they get around to trying to set up a space platform, scientists will be



faced with fancier timekeeping than the man on the flying trapeze. Rockets will have to meet in orbit hundreds of miles above the earth with millionth-of-a-second timing.

How fast is a second? Our present, and ancient, time system is based on the time it takes for the earth to rotate once. But the earth is gradually slowing down. Surely for the space age we need a more accurate standard.

JASON COSGROVE, Newark, N.J.

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Soon after enrolling, many NRI students start to earn $10, $15 a week in spare time fixing sets. Some pay for their training and enjoy extra luxuries this way. Some make enough to start their own Radio-TV shops. NRI training is *practical*—gets quick results. Easy to understand, well illustrated lessons teach you basic principles. And you LEARN-BY-DOING by practicing with kits of equipment which "bring to life" things you study.

### Find Out What NRI Offers

NRI has trained thousands for successful careers in Radio-TV. Study fast or slow—as you like. Diploma when you graduate. Mail coupon now. Paste it on a postcard or mail in envelope. ACTUAL LESSON FREE. Also 64 page catalog that shows opportunities, shows equipment you get. Cost of NRI courses low. Easy terms. **NATIONAL RADIO INSTITUTE, Dept. 9AB, Washington 16, D.C.**

## N.R.I. TRAINED THESE MEN FOR SUCCESS

"I was repairing Radios by 10th lesson. Now have good TV job." M. R. LINDEMUTH, Fort Wayne, Ind.

"Doing spare time repairs on Radio and TV. Soon servicing full time." CLYDE HIGGINS, Waltham, Mass.

"I had a successful Radio repair shop. Now I'm Engineer for WHPE." V.W.WORKMAN, High Point, N.C.

"There are a number of NRI graduates here. I can thank NRI for this job." JACK WAGNER, Lexington, N. C.

**VETERANS** Approved Under G.I. Bills

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Proto "BET'R-GRIP"® screwdriver handles give you extra gripping power, reduce fatigue. Result: more work with less effort.

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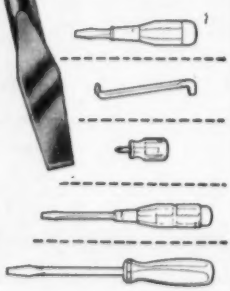

Proto screwdrivers are precision-designed, built to last longer. The alloy steel blades are heat treated their entire length. Plastic handles have extra deep flutes to prevent slippage and rolling. Wood handles are octagon shaped for sure grip, made of tough hardwood and (in most cases) protected by a ferrule and steel cap. At your dealers, be sure to pick Proto screwdrivers—they'll make your work easier. Send 10¢ for 84 page catalog describing entire line to Proto Tools, 2209 Santa Fe Ave., Los Angeles 54, Calif.

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*atoms of cesium. The atomic clock now checks time signals broadcast over short-wave radio. These time signals are used to set clocks all over the U.S., so unofficially you are already on "atomic time."*

**Likes Hard Bathtubs**

I HAD the good fortune to visit the Brussels Fair while on a business trip. Among other items to show the tremendous potential of the U.S. and our world-

famed American ingenuity: a bathtub lined with cushions! I haven't been able to face a tub without nausea since.

T. L. ROBINSON, NYC.

**He Disagrees on Stereo Hi-Fi**

I QUESTION the statement by R. S. Lanier ["The Facts About Stereo Hi-Fi," Oct.] that only the cartridge in the pickup unit has to be made special in such a system. A vertical motion is necessary to track the grooves cut in a stereo record using the Estrex 45-45 method. Although many older changers and turntables are satisfactory for playback of monaural recordings, the stereo recordings require special equipment.

Rumble and flutter—while tolerable with monaural recordings—prove annoying as well as detrimental with stereos. So most changer and turntable makers are producing specially designed motors and arms.

A top-quality transcription turntable may be satisfactory for the majority of stereo fans, but most changer units built before the stereo boom are not.

LOWELL P. AMOS, Toledo.

*Although stereo increases the importance of better turntables and tone arms, as noted in the article, only the pickup need be made* especially *for stereo. Many turntables and tone arms made before stereo are entirely adequate. And any improvements in upcoming models, precipitated by stereo, will also make them better*

# "We're looking for people who like to draw"

**By ALBERT DORNE**
**Famous Magazine Illustrator**

Do you like to draw or paint? If you do — America's 12 Most Famous Artists are looking for you. We'd like to help you find out if you have talent worth developing.

Here's why we make this offer. About ten years ago, my colleagues and I realized that too many people were missing wonderful careers in art . . . either because they hesitated to think they had talent . . . or because they couldn't get top-notch professional art training without leaving home or giving up their jobs.

**Plan to Help Others**

We decided to do something about this. First, we pooled the rich practical experience, the professional know-how, and the precious trade secrets that helped us reach the top. Then — illustrating this knowledge with over 5,000 special drawings and paintings—we created a complete course of art training that folks all over the country could take right in their own homes and in their own spare time.

Our training has helped thousands of men and women win the creative satisfactions and the cash rewards of part-time or full-time art careers. Here are just a few:

Don Smith lives in New Orleans. Three years ago Don knew nothing about art — even doubted he had talent. Today, he is an illustrator with a leading advertising agency—and has a future as big as he wants to make it.

**Helps Design New Cars**

Halfway through our training, railroad worker Don Golemba of Detroit landed a job in the styling department of a major automobile company. Now he helps design new car models.

John Whitaker of Memphis was an airline clerk when he began studying with us. Recently, a huge syndicate signed him to do a daily comic strip.

**Earns Seven Times as Much**

Eric Ericson of Minneapolis was a clerk when he enrolled with us. Now, he heads an advertising art studio business and earns *seven times* his former salary.

Having taken our training, busy New York mother, Elizabeth Merriss, now adds to her family's income by designing greeting cards and illustrating children's books.

**Cowboy Starts Art Business**

Donald Kern—a Montana cowboy—studied with us. Now he paints portraits, sells them for $250 each. And he gets all the business he can handle.

Gertrude Vander Poel had never drawn a thing until she started studying with us. Now a swank New York gallery exhibits her paintings for sale.

**Free Art Talent Test**

*How about you?* Wouldn't you like to find out if you have talent worth training for a full-time or part-time art career? Simply send for our revealing 12-page talent test. Thousands paid $1 for this test, but we'll send it to you *free*. If you show promise, you'll be eligible for at-home training under the program we direct. No obligation. Mail the coupon today.

**America's 12 Most Famous Artists**

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NORMAN ROCKWELL

JON WHITCOMB

AL PARKER

HAROLD VON SCHMIDT

STEVAN DOHANOS

FRED LUDEKENS

PETER HELCK

ROBERT FAWCETT

BEN STAHL

DONG KINGMAN

AUSTIN BRIGGS

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Mrs. _____ Age _____
Miss (please print)
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City _____ Zone _____
County _____ State _____

# ME—in a Rut?
## —COULD BE!

YES—you may be in a rut—just getting by—and not fully realizing it.

Every day you stay in that rut you "dig deeper"—make it harder and harder to get out.

So today while you think of it, take stock of yourself—are you getting ahead as fast as you should—are you satisfied to go along in a small job at small pay the rest of your life?

Hundreds of thousands of our students have won promotion and more money—and the prestige and happiness that success brings—perhaps we can help you.

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*Name*.....*Age*.....

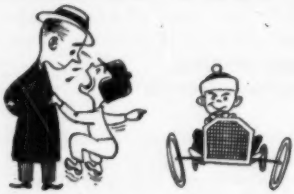
*Address*.....

*City*.....*Zone*.....*State*.....


*for monophonic use. Stereo simply makes intolerable the defects that were only annoying with mono records.*

**Plans Car, Lacks Plans**

For some time now, I've been looking for a fairly simple set of plans for a small car I can help our 12-year-old boy build:



Something that has a frame, four wheels, a steering device, and can be driven by a lawn-mower motor. I'm sure there must be many mechanically minded PS readers who have built such a small car. Perhaps some kind fellow reader will help me.

G. A. Riss, Willoughby, Ohio.

**Label Says It Isn't So**

Your chart listing various components on 1959 TV sets [Nov.] states that the three models of Motorola do not have power transformers. That is certainly incorrect as I have just bought a Motorola—chassis number 544—of "horizontal chassis design with new convection-cooled power transformer." It says so on the label.

C. J. Gataletto, New Rochelle, N.Y.

*Correct; model 544 has a power transformer. The error was caught too late to change it.*

**Straight Talk from a Student**

As a physics student, I find the new courses ["New Way to Teach Modern Science," Oct.] interesting and exciting. The how-it-works part of the regular physics course gives a student a very narrow field of vision, leaving him unable to cope with new problems.

After talking with friends taught the old way, I feel that I have a better understanding of physics than they. Maybe I can't repeat by rote how an engine works, as they can; but I've learned how to sit down with the facts and reason it out.

Richard M. Goldman, Pittsburgh.

[Continued on page 30]

# Stepping stones to success!

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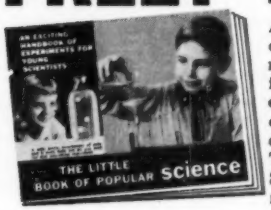


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# You ought to know...

**Gaslight again?** Is gas coming back to the home? The gas men haven't given up, though they've been losing so far in the battle with electricity. They're in there, burning to compete.

The big push is in the appliance field. A line of ultra-modern gas household gear that will do anything, or almost anything, that electricity will do has been developed by the gas industry. One problem: You may have to repipe your home.

Radically new gas appliances in design stage include portable plug-in burners, coffee makers and frypans, infrared rotisseries, gridless ranges. Not-so-new but redesigned heavier equipment includes house-heating systems and hot-water heaters.

All embody a new "power burner" principle. The idea is to improve combustion by closer control of the air part of the fuel-air mix. The units use two ducts: one for gas, the other for air, supplied at precisely the right volume-temperature-pressure. The mix results in most efficient burning *in a covered space* —with least waste.

Most dramatic is the gridless range. RCA Whirlpool—heavy dreamers for the industry in its market bid—developed it as part of their $250,000 "Miracle Kitchen." (It'll probably stay there for a while.) You can cook hamburgers directly on a flush surface built into a counter top. Flames are hidden underneath. The surface itself is Pyroceram—heat-resistant ceramic glass developed originally for rocket nose cones. Squares in different colors add eye appeal.

Portable appliances are also a Whirlpool dream, but much closer to market reality. The catch: You'll need extra gas outlets, just as you need wall sockets for electric portables.

Jet-Heet comes up with a different innovation—a gas range with hot-air cooking. Air heated to 1,000 degrees F. is directed to a perforated plate that forms the range top. Again no open flame, no grid, no muss.

Do you pine for the soft glow of gas lamps? At least half a dozen firms are in full production of elegant models for use outdoors. Most have traditional Welsbach mantles and glass or pyrex chimneys.

**Noticed the new pitch in car ads?** No more power raves. Detroit is plugging fuel economy in out-and-out imitation of foreign car appeal. Chevrolet and Edsel accent their six-cylinder models. Plymouth, Chrysler, Chevy, and even Cadillac all claim 10 percent better-than-last-year economy. Pontiac is way out with a 20-percent promise for its low-priced engine.

Some (notably Ford-Mercury-Edsel) stress they use regular rather than premium gas with savings up to a dollar a tankful. Tally for all the '59s shows that 19 say they can use regular, 27 premium. Last year's score: 13 to 33.

How do they do it? A little power sacrifice—with claims of better performance in "normal driving range." The Edsel 6

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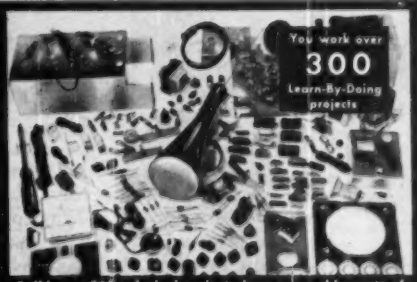


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# You ought to know...

has borrowed a Ford engine, while Mercury has cut horsepower in all series. Oldsmobile speaks of a new automatic two-way choke and an improved carburetor. Chrysler is betting on better carburetion, manifolding and rear-axle ratios.

The new line is old stuff for Rambler, which has been hitting at the "gas-guzzling dinosaurs" for some time. And Studebaker-Packard has high hopes for the Lark as a new entry in the economy-car bid.

**Beef-ier beef:** Federal scientists have come up with a new gimmick aimed at pleasing the Jack Sprats. It's silent sound waves—super-high-pitched (ultrasonic) signals that transmit varying echoes when they strike different densities in the animal's hide. Lean meat will sound a different note. Herders will be able to pick out exceptional beasts and keep them aside for breeding.

**A drive-in to trade-in** thrives in southern California. Every Sunday morning one drive-in movie converts to a mammoth swapping ground as citizens—white elephants in tow—come in to do business in the best Yankee horse-trading tradition. Sellers pay $2 a car for selling space; buyers a mere 25¢ a car. Thing's become so popular that vendors have started coming in Saturday night after the last show to stake out space.

**Longer cars may boost parking charges** at the same time they're boosting drivers' egos. Some garage owners, annoyed at wasted space, have started charging a premium on the bigger jobs. Other car briefs:

- ***Up gas tax?*** Threats of a federal tax increase for motorists loom as government budgeters foresee a billion-dollar red figure in the highway trust fund. The 3¢-a-gallon gas tax may be upped a penny or even more.
- ***How are foreign cars doing?*** Nicely, at 30,000 a month. Volkswagen is out in front with a 40-percent lead over second-place Renault. Next, in order, are English Ford, Fiat, MG, Vauxhall, Simca, Triumph, Volvo, and Hillman. California alone registered one out of every five imports sold in the U. S. during the first half of '58.
- ***Half-quart oil cans?*** Maybe. Manufacturers are experimenting with samples. They'll be a boon to small-car owners with odd-capacity crankcases.
- ***One tab for dining and car repairs?*** Tie-in credit cards are a possibility if Diners' Club and Ford officials agree. Members would be able to charge repairs on any make car—if done by a Mercury, Lincoln or Edsel dealer. Restaurant and repair charges would appear on one monthly bill.

**The "Continental" look** for men's clothes is in for '59. Translated, it means less shoulder, cutaway jackets tight-fitting throughout, even narrower trousers. You may not wear it, but the "pinch" may be felt all down the line.

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# THIS is how you train at home to become a SERVICE ENGINEER in the Air Conditioning and Refrigeration industry...

## An old industry offers bright new opportunities

Almost any industry has jobs for men with special skills. In many cases, good pay and steady work are the rule. Yet—would you be happy in being a repairman all your life? Wouldn't you rather have a job that presents a *challenge*—still *bigger* money—an opportunity to *grow?*

Listen, if you are ambitious to *keep climbing:* The air conditioning and refrigeration industry is growing so fast that 20,000 newly-trained technicians are needed each year. They can come only from the technical schools. Because installation and repair work is important, graduates may expect high pay and security right from the start. That's not all. *A well-trained technician has a great opportunity to develop into a Service Engineer.* As a matter of fact, 90 percent of all refrigeration engineers are former repairmen!

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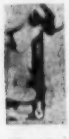

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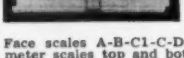

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# The month in science

**Cocktails: invitation to alcoholism?** The widespread American rite of gulping faintly flavored gin before dinner is under attack again—and this time not from the WCTU. The latest report from the Yale Center of Alcohol Studies tees off on the cocktail hour because it can lead to drunkenness. With scholarly restraint, the scientists say:

"If a social institution had been consciously created to foster . . . alcohol-addictive traits, it is difficult to imagine how a more effective mechanism could have been devised."

The report explains why:

1. Tiredness. At the end of a hard day, fatigue makes it easier for liquor to fog your brain.

2. Hunger. When you drink on an empty stomach, alcohol gets into your blood faster, in greater amounts, and stays there longer. It's the alcohol in your blood that counts.

3. Atmosphere. The pressure to assume gay sociability leads many people to get high on liquor purposely.

The blast against cocktails is only a one-page aside in "Alcohol in Italian Culture," a documented study of Italian eating and drinking habits. It concludes that Italians (and Americans of Italian ancestry) are so rarely alcoholic, even though they drink a lot, because (a) they consume mostly wine, (b) they consider it food, and (c) they drink it with their meals (not before). Italian-Americans, the report notes, become slightly more susceptible to alcoholism when the great U. S. melting pot introduces them to such un-Italian customs as drinking hard liquor without food —the cocktail hour.

**New metals for a new age.** Steel is fine for cars and boilers, aluminum okay for airplanes. But what do you use for space rockets and atomic engines? The requirements are staggering. The machines of the future need stuff that is strong as steel, lighter than aluminum, unaffected by atomic rays or searing heat. Already metallurgists have nine likely candidates bubbling on the back burners:

- Beryllium—now used mainly as an alloying element for copper. It is about half as heavy as aluminum, has a higher melting temperature. Big advantage: It does not interfere with the atom-splitting reaction (it slows down or reflects neutrons without absorbing them). Big disadvantage: It's brittle.
- Titanium—light, corrosion-resistant, strong, but reacts with air at very high temperatures. This one is already in commercial production (for airplanes) on a limited scale.
- Vanadium—good bet for high-temperature uses. It is not extremely strong, but retains what strength it has up to about 1,200 degrees. Very easy to weld and machine.
- Chromium (the shiny plating on bumpers and faucets)—strong and stable at very high temperatures, it promises alloys good

to 2,000 degrees. Unfortunately, like beryllium, it is brittle.

- Zirconium—quite strong, stands up well against corrosion. It is already in fairly large-scale production for atomic furnaces.
- Columbium—promises structural parts usable up to 2,400 degrees. It picks up oxygen and nitrogen from the air, turning brittle, but not too rapidly. Extra advantage: plentiful ore.
- Molybdenum—best of the high-temperature metals now in commercial production. Serious disadvantage: It deteriorates so rapidly in air that it must be protected with absolutely perfect coatings (a "brain-splitting" problem, says one metallurgist). Even a pinhole in the coating can make the whole part crumble.
- Tantalum—heavy, strong and tough. It is a sister metal to columbium, but soaks up neutrons from atomic reactions while columbium does not. Both occur in the same ore, and it is difficult to separate one from the other.
- Tungsten (today's light-bulb filaments)—"the whooperdo of all high-temperature structural materials," says Armour Research metallurgist Donald McPherson. Partly, that's a disadvantage. Tungsten is so difficult to melt that it is hard to work with.

But don't count good old steel out, not yet. New research promises to double its strength. This would cancel the weight advantage of exotic metals like titanium, since steel parts could be made much thinner.

Theoretically, iron should be fantastically strong—tensile strength of a million pounds per square inch. Perfect crystals of iron *are* that strong (large ones have been made, in the form of "whiskers," long but thinner than a hair). Ordinary iron and steel consist of imperfect crystals. The imperfections are like weak links in a chain, and the metal breaks there at loads far below the theoretical limit.

Ford metallurgists have now cooked up a steel that captures some of the strength of the perfect-crystal whiskers. An eighth-inch-thick wire of this super steel could hold up the heaviest '59 Ford—with passengers.

**Got any tornado pictures?** Weathermen are looking for photographs (still or movie) of tornadoes. With enough views of a storm from different directions, they can measure its size and features, using techniques of aerial mapping. This reveals such information as the location of the funnel (it's not under the main storm cloud, but hangs from a nearby stack of clouds).

Best photographed tornado so far is the one that hit Dallas in 1957. The Weather Bureau has 450 black-and-white photos, 100 color slides and 1,000 feet of movie film on that one.

If you have any good tornado snaps to contribute, send the prints (marked with place, date and time) to: Severe Local Storm Research Unit, Office of Meteorological Research, Weather Bureau, Washington 25, D. C.

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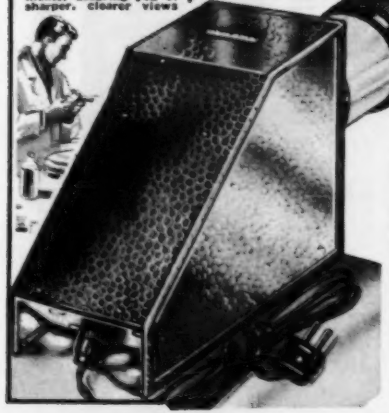

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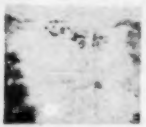

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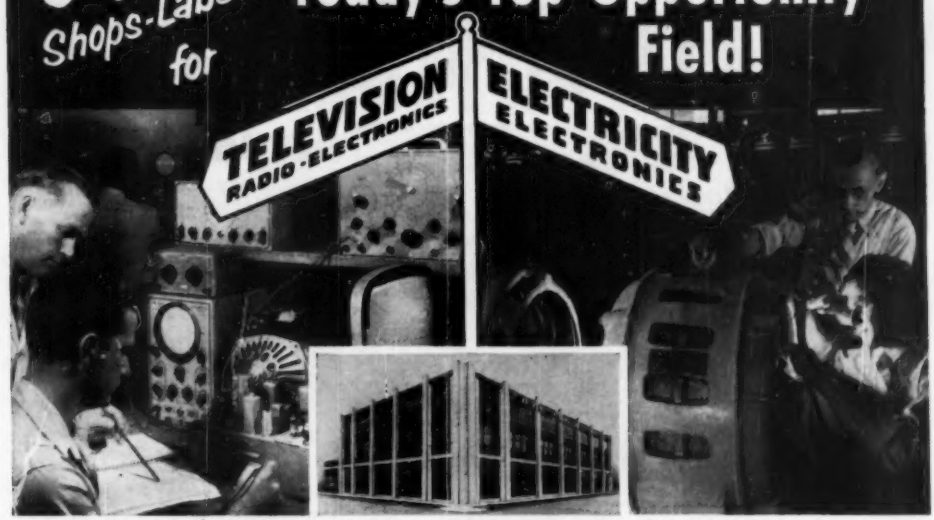


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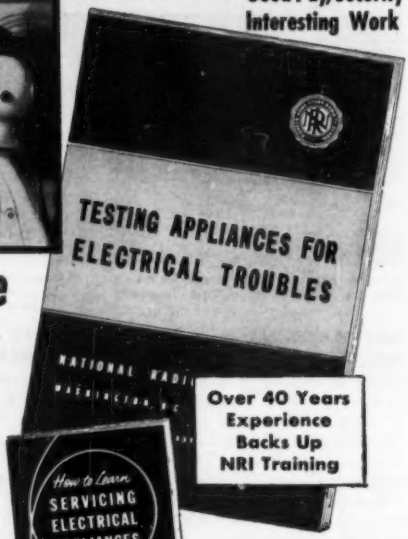


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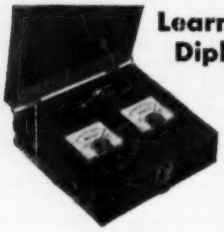

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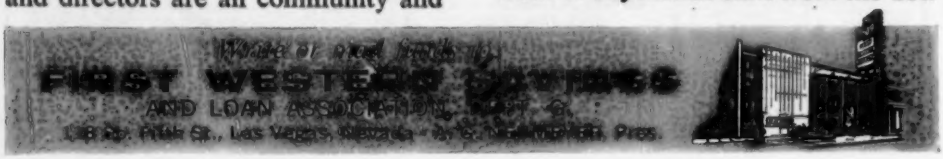

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## PS Readers Talk Back

[Continued from page 12]

### Next Step—Skidproof Roads?

I HAVEN'T seen anything in your pages about the new safety pavement on our San Francisco-Oakland Bay Bridge. Guardkote—a plastic—was poured over the surface, then covered with grit as it hardened. The result is a thin, sandlike coating that's skid-resistant even when wet. They say cars stop in half to three-quarters of the distance needed on concrete. Maybe this top coating is the answer to how to cut down skids on dangerously smooth or oil-slick grades and curves, too.

C. L. SNOW, San Francisco.

### That Hot-and-Cold Machine

SINCE any resistance heater converts electrical energy completely into heat, its efficiency is 100 percent. This makes me wonder what you mean when you say a semiconductor thermoelement ["A Reversing Hot-and-Cold Machine," Oct.] as a heater "is much more efficient than a regular resistance heater."

ANATOLIJ BOJKO, Los Angeles.

*Thermoelectric engineers claim their devices are more efficient because the only electrical loss is resistance—which produces heat, adding to the heat pumped by the semiconductor. There's no standard method for computing heater efficiency, but if you use this reasoning, you get an efficiency above 100 percent.*

*Semiconductors are better heaters than resistance devices because they convert more of the electricity into useful heat (of the desired wave length). But even semiconductors abide by the energy-conservation laws.*

### Walls of Wheat?

LAST year, wheat harvested in this country amounted to three times more than we could use. Bushels by the millions were turned in for government price-support loans. And every year the storage problem gets worse.

Couldn't the surplus grain be sold cheaply to manufacturers of wallboard? They make paneling of cornstalks, wood chips and other waste. Why not of grain? No matter how little was paid for it, it would mean money in the till.

J. L. DUTTON, Athol, Mass.

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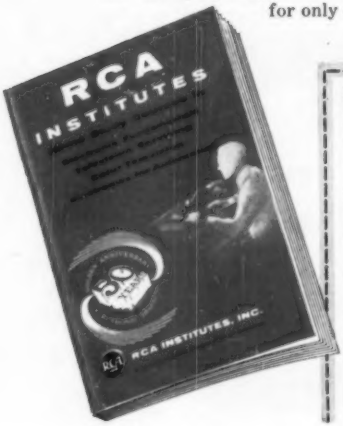


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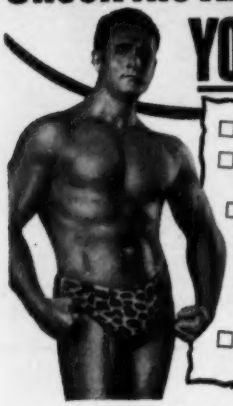

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- ☐ More Energy, More Restful Sleep

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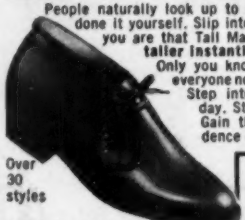

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***by Harold Holmes***

"Just a few months ago I made the big move. I gave up my job and started spending all my time in the little business I had been running on the side. It wasn't an easy decision, but, now I'm tickled to death I made it. Not just because I'm my own boss or because I have an excellent chance of making over $10,000 this year. It goes deeper than that.

"You see, this idea has caught on like wildfire in my town. Not a day goes by without my phone ringing with women calling for appointments. The beauty of it is that once a woman becomes my customer, she calls back year after year. Not only that, she tells her friends, too, and they call me. Before I know it I'm swamped with work. (And at $7.50 an hour net profit it doesn't take long before my bank account is really mushrooming.)

"Funny thing, but back last year, before I started, I never realized the money there was in this business waiting for someone to come along and collect it. Just think: every house in town has furniture and most have rugs or carpeting. I concentrate on just the better homes and have more work than I can handle. You know why? Because women are fussy about their furnishings. Can't stand to see them dirty. That's why they call me over every year.

"The average job is worth $25.00 to me and takes a little over 2 hours. Out of this, after paying for materials, advertising and other expenses I net about $15.00 clear profit. This means I need just 3 jobs a day to clear $11,250.00 in a year. Frankly, since this will be my first full-time year I'll be glad to hit the $10,000 mark. But after that this business should grow larger each year until I have to hire men to help me handle the business.

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"Believe me there's nothing magic about it. I didn't know a thing about cleaning home furnishings before I became a Duraclean dealer. But after my application was accepted, I was trained in their factory-training school and by a dealer in a nearby town. I was astonished by the short time it took me to become an expert. Actually, much of the credit must go to the Duraclean process, which is so safe it has earned the Parents' Magazine Seal.

"The portable machine you see is just one of the electrical machines I use. It manufactures a light aerated foam with a peculiar action chemists call 'peptizing'. It means that instead of being scrubbed deep into the fabric, dirt is gently ABSORBED by the foam, leaving the fabric clean all the way down. Women can't believe their eyes when they see how it works. Colors appear bright again, and rug pile unmats and rises like new. I don't have to soak rugs or upholstery to get them clean, which ends the problem of shrinkage, and means the furnishings can be used again the very same day. This alone has brought me a lot of customers.

"As a Duraclean dealer I make money with four other services, too: ***Duraproof*** . . which makes furnishings immune to moth and carpet beetle damage (it's backed by a six year warranty), ***Durashield,*** a brand new dirt-delaying treatment. It coats fabrics with an invisible film that keeps dirt out. ***Duraguard,*** another new service, flameproofs draperies, upholstery and carpets to reduce charring and the tendency of fires to flame up. And ***Spotcraft,*** which consists of special chemical products for removing stubborn spots and stains. On jobs where I perform all five services, I multiply profits!

"One of the nicest things about being a Duraclean dealer is that I get continuous help from Duraclean Headquarters. My services are nationally-advertised in famous magazines like McCall's, House Beautiful and many others. I also get a complete advertising kit prepared by experts. (There's even a musical commercial!) I get a monthly magazine full of methods to build business and I can meet with other dealers at Duraclean conventions. I'm also backed by insurance. In fact there are over 25 regular services I get under their unique System.

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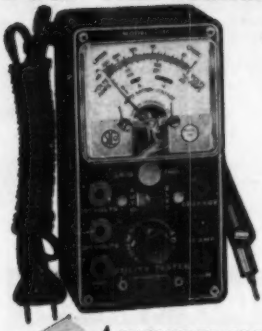

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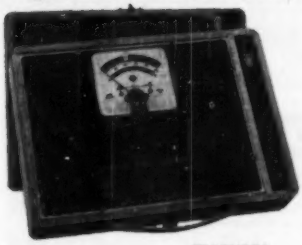

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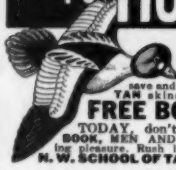

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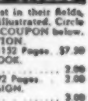

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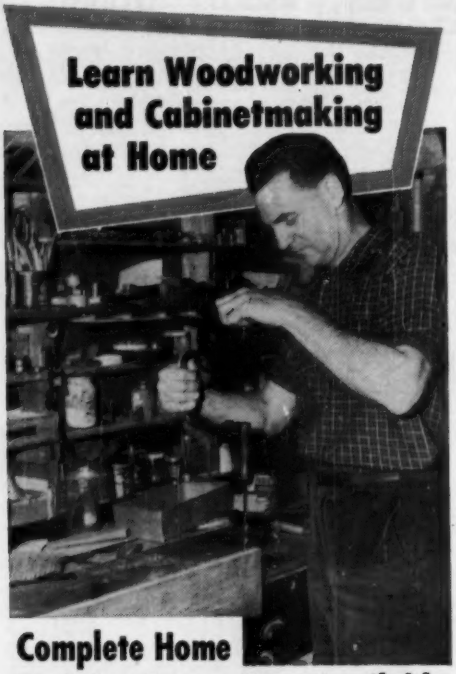


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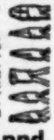

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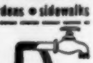

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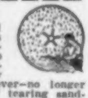

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Available in 3 Sizes of Grit Fine Grit (150) Medium Grit (80) Coarse Grit (60)

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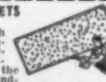

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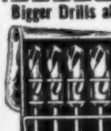

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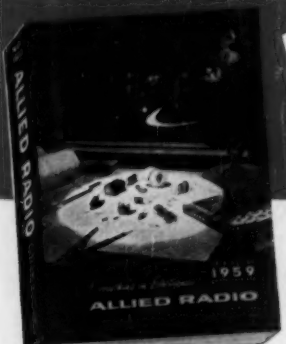


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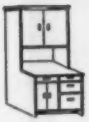

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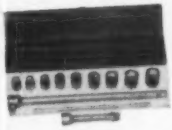

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# MEMORY UNLIMITED

I JUMPED into the first railway compartment which seemed empty: my eyes fell on a book left on the seat opposite by a previous passenger.

I took it up absent-mindedly and ran through the first lines. Five minutes later I was reading it as eagerly as a clue to a hidden treasure. I learned that everyone's memory is capable of fantastic feats; that an ordinary person if he has taught himself to control the way in which his brain stores impressions can memorize accurately long and complicated lists of facts after reading them over only once or twice. I thought I would test the truth of the statement.

I took a timetable out of my suitcase and began reading quietly in the manner prescribed, the names of about one hundred railway stations. I observed that, after reading them over a few times, I could recite the whole list off with hardly a mistake. With a little more practice I found I had committed them so completely to memory that I could remember them in the reverse order and even pick out one station from the list and say which number it was, and what were the names of the towns before and after it.

I was astonished at the memory I had acquired and spent the rest of my journey on more and more difficult experiments in memory, and reflecting how this new control I was achieving over my mind would materially help me to a greater success in life. After this, I worked hard at this wonderful memory system, and within a week I found I could recall passages from books and quote them with ease; names, addresses and business appointments were remembered immediately; and in four months I had succeeded in learning Spanish.

If I have obtained from life a measure of wealth and happiness, it is to that book I owe it, for it revealed to me the workings of my brain.

Three years ago, I had the good fortune to meet its author, and I promised him to propagate his method, and today I am glad of this opportunity of expressing my gratitude to him.

I can only suppose that others wish to acquire what is, after all, the most valuable asset towards success in life.

Borg's address is: R. D. Borg, c/o Aubanel Publishers, 14 Highfield Road (Rathgar), Dublin, Ireland. Apply to him for his little book, "The Eternal Laws of Success." It is free to all who wish to develop their memory.

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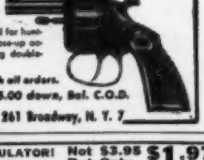

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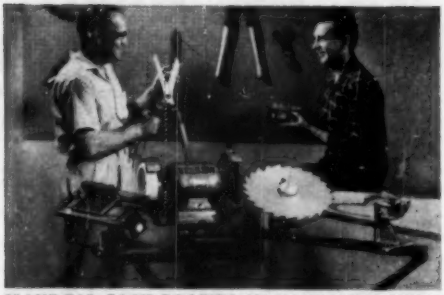

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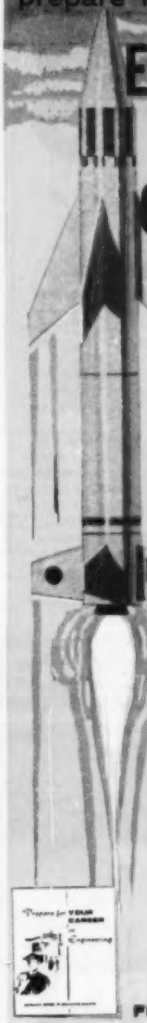

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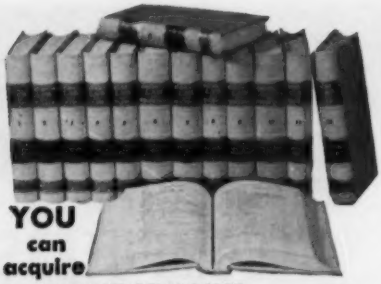

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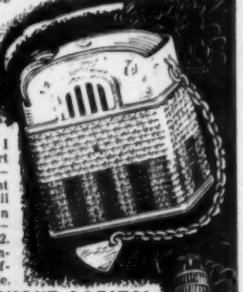

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As startling first-hand proof I will send you an actual import from overseas, **AT MY COST** – something to see and use. Just mail me 25¢ in coin and I will rush you this Imported Melson Automatic cigarette lighter – made to retail in the U.S. at $2. This magnificent Import will convince you of the tremendous profits being made in World Trade.

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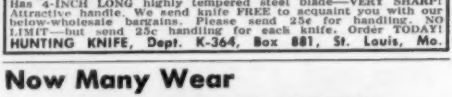

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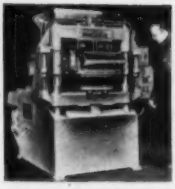

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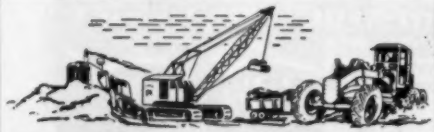

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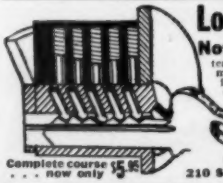

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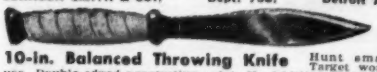

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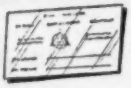

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AMAZING Profits! Sensational Home Mailorder opportunities. National, 2694 So. 10th, Fresno 25, California.

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PROFITABLE Notary Public Licenses available your State Now. Write Notarizers' 3230-S1 Stoner, Los Angeles 66, Calif.

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$250 WEEK reported! Free book "505 Odd, Successful Businesses." Work home! Expect something Odd! Pacific-36C, Oceanside, California.

$30-$60 WEEKLY addressing envelopes. Instructions $1, refundable. Reiss, 210 Fifth Ave., Suite 1102-W, New York 10.

START a profitable business sharpening scissors, pinking shears, on precision electric machine. No experience necessary. Easisharp, 4219-B Rocky River Drive, Cleveland 35, Ohio.

BEFORE starting any mailorder business read "Mailorder Laws and Regulations" and "Mailorder Rules for Beginners." $2.00. Licenses, taxes, legal requirements explained. Tasker, Box 3131, Alexandria, Virginia.

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FREE Folio "$5,000-$45,000; Unlimited Vacations." No merchandise. Unknown! Work home! Haylings—S-16, Carlsbad, Calif.

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LIQUID Molding Rubber, Free Sample. Shellcraft Supplies, Chaney's, 1907-C East Road, Jacksonville 11, Fla.

SNAPPY imprint circular offers folio on making money typing and addressing at home. Wholesale to dealers. Long profit margin. Damante, Box 3536, Cleveland 18, Ohio.

GUARANTEED Moneymaker! Millions want Battery rejuvenator—everywhere. Sample $1.00. Laboratories, Charleston 28-D, South Carolina.

MUSHROOMS Quicker, Easier, Cheaper. "Magic" preplanted trays. Newest Facts Free. Spawn $1.00. Luxorco, 641 South 19th, Newark 3, N. J.

METALIZE Baby Shoes; Repair Dolls; Rebuild Batteries; Catalogue "75 ideas" Free. Universal, Box 1076-B, Peoria, Illinois.

"SURE-Fire" Mail-Order Plan! Your own business at home, spare or full time. Complete Plan shows how. Free details. Elmer Hayes, B-31, Palo, Iowa.

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START Profitable Mail Order Business. Home Operated, Everything Furnished. Wayne's Service, 3016—Channing N. E., Washington 18, D. C.

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MAKE Money By Mail. Details $1.00 Refundable. Tyrer Associates, House Springs, Missouri.

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BIG Multicolor Wholesale Catalog! Housewares, appliances, clothing, silverware, cookware, luggage, binoculars, shavers, radios, phonographs, cameras, projectors, recorders, typewriters, sewing machines, furniture, power tools, toys, sporting goods, watches, diamonds, jewelry, automobiles, etc. Name brands. Huge discounts. Postcard: Selbyco, Decatur 164, Illinois.

LARGEST Wholesale Supply Source in U.S. Get free catalogs. Furniture, clothing, appliances, autos and accessories, farm equipment, tools, housewares, hobby supplies. Free details. Associated Wholesalers, Box 52-C, Burlington, Iowa.

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SPECIAL Formulas for latest moneymaking discoveries. New! Good! Profitable! Valuable Literature Free! Miller, Chemist, 1517-N, Tampa, Florida.

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NEW—Electric Laminating Kit. Hobby. Profitable. Laminating, Burr, 330-1 East Center, Kalamazoo, Mich.

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## 42 HELP WANTED REPORTS

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AMERICAN Overseas Jobs. High Pay. Men, Women. Transportation Paid. Free Information. Transworld, Dept. 10C, 200 West 34th St., New York 1.

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IF you're interested in making money in selling, see the hundreds of exceptional opportunities in Salesmen's Opportunity Magazine. Send name for your copy, absolutely free. Tell us what you're selling now. Opportunity, 848 N. Dearborn, Dept. 18, Chicago 10, Illinois.

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## 53 ADVERTISING, AGENCIES, ETC., FOR ADVERTISERS

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MAKE Money! Take big profit orders, famous Fruit Trees . . . including sensational discovery—Starkrimson Delicious Apple! Also Dwarfs, Shrubs, Roses, Vines. Sales outfit Free. Stark Bro's, Desk 30119, Louisiana, Missouri.

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AMAZING opportunity. New low priced fire alarm protects homes, farms, offices, factories, etc. No wiring—hangs like picture. Pays up to $1,100 a month. Free kit. Merlite (Alarm Div.), 114 E. 32nd St., Dept. P-66T, New York 16, N.Y.

SALESMEN—Big money every day showing nationally known drain cleaner. No chemicals. Nothing like it. Minute demonstration. Commissions paid daily. Sample furnished. Campbell Co., (Est. 1928), Rochelle 605, Illinois.

AMAZING New Liquid keeps hands clean forever! Not a cleaner—not a detergent—not a soap, but a sensational new chemist's discovery that vigorously resists soil of all kinds. Terrific 60-second demonstration sells on sight. Big extra profit details Free! Jet Products, Wampum 2, Penna.

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FOR Easiest Extra Money, get samples of 1959's fastest-selling Greeting Card Assortments, Gifts, Exclusive Stationery. Lovelier, bigger values, more profitable. Cash bonus, too. Big line. Samples on approval. $1.25 Gift introductory offer Free. Cardinal, 1400 State, Dept. A-80, Cincinnati 14.

CASH commissions at once, taking orders for magazines every family wants! No experience needed. For Free money-making kit, with everything you need, write McGregor Magazine Agency, Dept. 331, Mount Morris, Ill.

I'LL send you Free stocking sample newest advancement in hosiery since nylon. Patented, full-length. Stays up over-the-knee without supporters, without girdle! Nationally advertised price $1.95. Make money introducing to friends at $1.00 pair. American Mills, Dept. 668, Indianapolis, Ind.

NEW 159% profit aerosol wax shoe shine. High lustre polish to any color shoe. Fast seller. Sample $1. Write Easy-Wax-Shine, 74-80 Washington Street, New York City.

BIG Money making Opportunity. Exclusive line uniforms, jackets, pants, shirts, coveralls, sportwear. Advertising embroidered. Every business prospect. Get Selling Outfit Free! Master Co., Dept. K-23, Ligonier, Indiana.

AMAZING Greeting Card Money-Maker—Make $75.00 on 100 Deluxe $1.25 Assortments. Newest 21 for $1 Tall Cards, Gift Novelties, 125 fast sellers. Gift Bonuses besides biggest profits. Experience unnecessary. Stationery samples Free, others on approval. $1.00 Gift for prompt action. Creative Cards, 4401 Cermak, Dept. 526-K, Chicago 23.

WILL you wear new suits and topcoats without one penny cost and agree to show them to friends? You can make up to $30.00 in a day even in spare time, without canvassing. Progress Tailoring Co., 500 S. Throop St., Dept. J-326, Chicago 7, Ill.

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!!FREE!! Leathercraft catalog. Hundreds of new items. Write MacPherson Bros. Leather Company, Dept. A, 730 Mission St., San Francisco 3, Calif.

LEATHERCRAFT. Finer leather, tools, kits, complete catalog 25c. Midas, Box 1255, Dept. R8, Huntington Park, California.

CACTUSWOOD—Make Ashtrays, Vases, Lamps. Catalogue 10c. Accco, 2215 North 24th, Phoenix, Ariz.

KNOCKDOWN Cedar Chests Also Over Fifty Kits. Catalog 25c. Giles Kendall Co., Huntsville, Alabama.

## 66 DO IT YOURSELF

GRANDFATHER Clock movements, barometers, blueprints, kits. Wholesale catalog 25c. Mason-Sullivan, Noroton 2, Conn.

MOUNT your own deer horns. Complete kit with instructions. Only $5.95 prepaid in U.S. Conaways, Box 7261PS, San Antonio 10, Texas.

FIREPLACES you can build for under $100. Plans and instructions for three recreation room fireplaces—$1.00. Lockhart Development, 5056 Belwood, Hopkins, Minn.

## 67 OLD GOLD, JEWELRY, WATCHES, ETC.

USED and new watches $2 up. Free List. Southern Watches, 5-PS So. Wabash, Chicago 3.

FREE catalog. Costume jewelry parts. Supplies. Reasonable prices. Fast service. Guaranteed quality. Unique merchandise. Folsom's, Box 52, Medford 55, Massachusetts.

COSTUME Jewelry Supplies. Settings, Rhinestone, etc. 88 page illustrated catalog, 25c. Milady, Box 1328 G.P.O., New York City (1).

HIGHEST Cash For Old Gold, Broken Jewelry, Gold Teeth, Watches, Diamonds, Silverware, Spectacles, Platinum, Mercury. Free information. Rose Refiners, Heyworth Bldg., Chicago 2.

PROTECTS FURNITURE, CARS, APPLIANCES, ETC.

FREE! LAFAYETTE'S 1959

DIAMOND Jewelry. Free Merchandise. Literature. Solitaire. 349 Salem, Billerica, Mass.

HIGHEST Cash Paid For Old Gold, Jewelry, Gold Teeth, Diamonds, Watches, Silver, Mail Articles Today. Information Free. Chicago Gold Refining Co., 6 E. Monroe, Dept. 957, Chicago 3.

## 69 FOR THE HOME

FOAM rubber furniture cushions—Factory seconds 50% discount. Free catalog. Perma-Foam, 390-A Nye Ave., Irvington, New Jersey.

CESSPOOLS, septic tanks, outdoor toilets, cleaned, deodorized without digging, pumping or moving. Free details. Chemical Cesspool Cleaning Company, Boston 34, Massachusetts.

## 70 OF INTEREST TO WOMEN

$25.00 A Day Easy With 60% Profit. Friends and neighbors will thank you for demonstrating new beauty tips and most glamorous ways to use famous Studio Girl Hollywood Cosmetics. Information I send you quickly qualifies you as a Beauty Advisor so you can make up to $25.00 or more a day to start—or $5.00 an hour for spare time. If you write me today I will include actual samples for which you pay nothing —now or ever. Send name—letter or postcard—to me personally. Harry Taylor, President, Studio Girl Cosmetics, Dept. 1191K, Glendale, Calif.

GOOD Money 'n Weaving. Weave rugs at home for neighbors on $49.50 Union Loom. Thousands doing it. Booklet free. Carlcraft Co., Power Street, Boonville, New York.

HOUSEWIVES—earn $60 weekly at home. No selling. Dignified work. Opportunities, P.O. Box 8057, Fort Worth, Texas.

MAKE $25 to $35 weekly addressing envelopes. Our instructions reveal how. Glenway, Box 6568, Cleveland 1, Ohio.

$200. MONTHLY Possible, Sewing Babywear! No house selling. Free Information. Send name to Cuties, Warsaw 14, Indiana.

$1,000-$5,000 YEARLY Possible, addressing envelopes, postcards, for advertisers! Further information free. Mann, 424-C, Woodcliff Lake, N.J.

MAKE life-like wood fibre flowers. Beginners' kit, $1.00. Hauser House, Box 6424-PS, Phoenix, Arizona.

## 71 FOR SALE MISCELLANEOUS

CLEARANCE Sale Offers. Special Sale Offer of pure wool Scotch Tweeds and Suitings, 54/56 inches wide, suitable for ladies, gents and children's suits, coats and dresses; this is part of a cancelled U.S.A. order made to sell at over $5.88 per yard; our price only $2.40 per yard. Cannot be repeated at this price. Send stamp for free patterns. Special offer of Ladies Fair Isle Yoke Lumber jackets, fawn or grey backgrounds, lovely traditional Fair Isle designs, sizes 32" to 42" bust, only $7.35 each; were $9.66 each earlier this year. Outsizes to order. Sale offer of all wool Tartan Rugs, full size, in Royal Stuart, Dress Stuart (the Royal Tartans), Black Watch, Hamilton, Cameron, Wallace, Robertson, Menzies, Macpherson, Fraser, Macdonald, and Buchanan, only $6.65 each, Reduced from $9.66 each. All our customers are delighted with these. Short-sleeved Shetland jumpers, fawn only, sizes 34" and 36" only, lacey or plain stitch, to clear at $4.90 each. Hand-knitted Harris Wool socks, sizes 7" to 12" foot, price $1.12 per pair, post free; 3 pairs for $3.15 post free; 6 pairs for $6.10 post free. Send for bargain price list of Harris Tweeds, Shetland Wools, bedding, children's wear and gift voucher value 35 cents on request. Easy-payment terms available. Money refund guarantee. Hebridean Crofter Weavers Ltd., Dept. P.S., Muir of Aird, Benbecula, Outer Hebrides, Scotland.

BULLFIGHT Poster, Authentic 20x48. Your Name As Matador, $1.25 Check or M.O. Wine-Skins $2.00. Ted Gregory, Casa Cartuja, Paguera, Mallorca, Spain.

BOOMERANG — Australian Aborigines "throwing stick" $3.75 postpaid. E. N. Templin, 2935-A Victoria Ave., Norfolk 4, Virginia.

DRIVE safely and comfortably. Dixie Life Saver Sponges keep fog off windshields for hours. 2 sponges only $1 from GBC Distributors, Box 8222, Memphis 4, Tenn.

## 72 WANTED TO BUY

QUICKSILVER, platinum, silver, gold. Ores analyzed. Mercury Terminal, Norwood, Massachusetts.

## 75 TATTOOING SUPPLIES

LEARN profitable, fascinating Tattooing. Illustrated information $1.00. Zeis, 728-B Leslie Rockford, Illinois.

## 77 GEIGER COUNTERS & TREASURE FINDERS

FIND lost or hidden treasures with new transistor metal detector, underwater metal detectors, scintillation counters, etc. Free literature. Gardiner Electronics, Dept. 1, 2345 E. Indian School Road, Phoenix, Arizona.

TREASURE! Buried coins, gold, silverware, relics. Transistorized M-Scope locates them! From $59.50. Easy Terms. Free Catalog. Fisher Research, Dept. C-2, Palo Alto, Calif.

MINERAL Map of Canada. Showing Complete Mining Areas of Gold, Uranium, Silver, Copper, etc. Over 1,000,000 sq. miles. Excellent for exploration and reference. Only $1 to Mineral Club of Canada, S. W. Box 187, Windsor, Ontario.

TREASURE information, books, maps, free catalog. Big map, 445 locations, $1.00. Anchor Archives, Rye, N. Y.

NEW—Extremely lightweight economical transistorized metal detectors. Waterproof Search head. Kit or Assembled Models. Geiger Counters and Mineralights. Free Literature. Electronic Applications, Dept. M. P. O. Box 8, Arlington 10, Virginia.

MANUFACTURE of a New Electronic Indicator To Find Metals. Elmer Detweiler,719 Emerson St., Goshen, Ind.

TREASURE! Exciting Handbook 25c. Locators. Howe, 811 Kansas, Atchison, Kansas.

## 78 WATCH REPAIRING

WATCH and clock repairing books. Free catalog. North American, 2320-BA Milwaukee, Chicago 47, Illinois.

GUARANTEED watch repair $3.95. Automatics $4.95. Lans', 17 South Center, American Fork, Utah.

## 78A TEETH

DENTURES loose? Painful? Troublesome? Sore gums? Valuable new helpful information free. Baker, 85 (PS19), Elyria, Ohio.

DENTURE cleaner liquid. One cent application. Soaks cleaner, easier, faster. Harmless. Denture breath disappears. Send name, address with $1.00 for simple formula to The Eden Co., 244 W. Joaquin Ave., San Leandro, California.

## 79 MISCELLANEOUS

PERPETUAL Motion? Amazing Solar Motor Runs Continuously Powered By Light. Free Details. Sample $1.50. Guaranteed. Macleans, Box 564, Houma, Louisiana.

ROULETTE System, advanced. Theoretically foolproof. Instructions $1.00. Sherwood, 421 Fontenelle, Grand Rapids 8, Michigan.

FREE Folder Gives Helpful Hints About What To Do Before, After And During An Atomic Attack. Write Atomic Aid, 215 West 34th Street, New York City 1.

YOUR Name On Giant Mailing List. Receive Offers Galore. Send 25c. Direct Mail Service Co., P. O. Box 581, Bakersfield, Calif.

RECEIVE—Magazine Samples, Mails, Catalogues, Bargains From Everywhere. Get Listed 25c. Rorick's, Cincinnati 26, Ohio.

LETTERS, greeting cards remailed from N.Y., world's greatest city, 25c. 5 for $1.00. Realrmails 40c, 3 for $1.00. Francis, P.O. Box 523, New York 8.

COIN Purse Guaranteed To Please The Men. $2.00 PP. Jhal Enterprises, Olanta, S. C.

RECEIVE mails, magazines, samples. Your name in numerous mailing lists 25c. Greenwood, Box 1116-KP, New York City 8.

NEW YORK City Remailing. Manhattan, Queens, or Brooklyn, 25c. Classifieds, $1.00. Gelling, 740—54th Street, Brooklyn 20, New York.

"VENTRILOQUISM Selftaught" — complete book 25c: Greenview, Box 61-AF, Whitestone 57, New York.

FREE Vitamin Catalogue—Feel more vigorous, better—younger. Protect your health. Potent formulas, quality capsules —like doctors, hospitals buy. Buy direct—save! Vitacenter, Drawer 2318-E, Detroit 31.

ELECTRONIC Sleep Inducer. Completely harmless. Free literature. Gardiner Electronics Co., Dept. 26, 2345 East Indian School, Phoenix, Arizona.

## 79B SWAP

READ, "Trading Post Magazine" 10c. Thorne's, 525 Dewey, Jackson 35, Michigan.

## 80 PERSONAL

"YOU Can Find [illegible]" Confidential information develop[illegible] matter, person, anywhere. Official [illegible]sed. Established 1922. Equitable Se[illegible]ureau, 15 Maiden Lane, New York.

BORROW By Mail. $100-$600. Anywhere. Air Mail Service. Postal Finance, 200 Keeline Building, Dept. 916A, Omaha 2, Nebraska.

GAIN Self Confidence, Memory Power, Magnetic Personality by recordings. Invisible Psychologist, Box 24-NN, Olympia, Washington.

MIAMI Beach, Florida. Remails 25c. Monthly $3.00. Sunday Classifieds. Any Newspaper, $1.00. Air Mailed $1.50. RKO, Box 4141-A.

MEXICAN Legal Matters. A. Espejo, Box 217, Tijuana, Mexico.

SAVE 50% On Vitamins. New, free catalogue lists all brands, formulas, prices. Compare and save. State vitamins now using. Vitamin Specialties, Box 4435-B, Philadelphia 40, Pa.

LEGAL Form For Making A Will $1.00. Curtiss Folio Publications, 1412 Great Northern Bldg., Chicago 4, Ill.

BORROW $50 to $600 By Mail. Quick, Easy, Private. No Co-Signers. Repay in 24 small monthly payments. For the amount you want write today to Dial Finance Co., 410 Kilpatrick Bldg., Dept. A-1, Omaha 2, Nebr.

PSORIASIS Sufferers: Discouraged? Write today for Free important information. Pixacol Co., Box 3583-PS, Cleveland 18, Ohio.

IDENTIFICATION Cards All Trades, Professions, Men, Women. Apply G. A. Hunter, 769 East Hastings, Vancouver, Canada.

ADULTS: Receive interesting mail—10c. Woodward, 23-A Mahoney, Hamilton, Canada.

100% PROFIT on Vitamins. Details. Lindstrom, 48 Boylston, Cambridge, Mass.

TIRED, Vigorless, can't get 40 hours in. 25c brings new exciting information. Foodarama Research Laboratories, 276, Verdugo City 11, Calif.

SUPER memory overnight! Success guaranteed! Bijou, Box 1727-V, Hollywood 28, Calif.

FLORIDA Jobs Available. Sunday Classified $1.00. Remails 25c. Grimm, Box 1781, Tampa 1, Fla.

SECRET Mail Address. $3.00 Month. Hedgpeth, Box 830, Alhambra 24, Calif.

"COBRA. Self-defense street-fighting tricks." Designed to help peaceful adults. $2 Gaucho, 846-S6 Sunnyside, Chicago 40.

HAWAII! Confidential Receiving-Forwarding $3.00 month. Write: Fobel, 617-J Kuasina, Kailua, Hawaii.

MAIL Received, Forwarded, 25c letter, $3.00 month. Lloyd Moffitt, 319 1st, West Palm Beach, Fla.

FACIAL Therapy Controls Wrinkles If Lotions Fail. $2. Details. Ernelda Gardiner, 330 East 257 St., Euclid 32, Ohio.

"PSYCHIC Dominance. Rule others with your thoughts." Full course—with stirring exercises. $3. (Adults.) Satisfaction or refund. Clarion, 846-S6 Sunnyside, Chicago 40.

MEXICAN Law. Attorney Ceniceros, Apt. 79—Cd. Juárez, Chih., Mexico.

AFRAID of Girls? Stop! Improve yourself! Know "What" to do. Confidential. "Winning Ways," $1.98. Success or refund! Wilford, Box 7400, Washington 4, D. C.

HEARING-Aid users, guaranteed better telephone hearing $1.00. Phonaid, 1504 Brooklyn, Ann Arbor 2, Mich.

YOUR Name In Gold on genuine leather key case 10c postpaid. Print name plainly. Royal Sales, Summerside, P. E. I., Canada.

PUERTO Rico remails 50c, airmailed $1.00. L&M Specialties, Box 10818, Caparra Heights, P.R.

WAKE up your mind! Be what you desire! Smash worries, fears, indecisions, inferiority. Life-changing facts free. Write Box 1924-Y, Louisville 1, Kentucky.

NOW You Can Fix Your Own Zippers. Pamphlet $1.00. Epperson's, 1735 Broadway, Quincy, Illinois.

PROTECTS FURNITURE, CARS, APPLIANCES, ETC.

# 2 GIANT PLASTIC SHEETS $1

## 216 SQ. FT. IN ALL

*Twice as much as others give you.*

Others charge $1.00 for **ONE** big 9 x 12-ft. size transparent, one-piece, no seam Plastic Cloth, but our price is only **$1.00** for TWO! Tremendous number of uses—wonderful for covering cars, boats, bicycles, baby carriages, appliances, indoor or outdoor furniture, rugs, fans, air conditioners, tools, houseware, etc. Perfect for covering walls, floors, steps, furniture, when papering, painting, washing walls, etc. Make Aprons, Tablecloths, Auto Seat Covers, Furniture Slip Covers, etc. Cuts easily with scissors. Can be pieced or sealed together without sewing. Waterproof, greaseproof. Never needs washing or ironing—just wet and rinse. STRONG and tear-resistant. You MUST be thrilled, or money refunded! Send $1.00 plus 25¢ for pstg. & hdlg. or **$1.25** in all for each **TWO** 9 x 12-ft. (216 sq. ft.) sheets. Order Now!

**L & M CO.**

**Dept. PL-141, Box 881, St. Louis, Mo.**



# FREE! LAFAYETTE'S 1959 CATALOG

**260 GIANT-SIZED PAGES**

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HUNDREDS OF EXCLUSIVE LAFAYETTE ITEMS NOT IN ANY OTHER CATALOG OR AVAILABLE FROM ANY OTHER SOURCE—SEND FOR YOUR COPY NOW!

See the newest and finest in Stereo Tuners, Amplifiers, Cartridges and Music Systems

Everything in Electronics

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The most complete electronic supply catalog crammed full of everything electronic at our customary down-to-earth money-saving prices.

The largest selection of hi-fi components and systems; greatest savings on Lafayette endorsed "best-buy" complete systems.

EASY PAY TERMS AVAILABLE — 10% DOWN — UP TO 18 MONTHS TO PAY

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☐ Send FREE LAFAYETTE Catalog 590

Name .....

Address .....

City ..... Zone ..... State .....

The skilled hand of the German gunsmith is responsible for this .22 caliber, 6-shot repeater automatic with self-ejecting clip. Just 4" long, fits easily into pocket or purse. Ideal for sporting events, stage use.

*(Not available to California residents).*

**Comes for $6.95 ppd. from BEST VALUES**

Dept. G-361, 403 Market, Newark, New Jersey

**HULL AUTO COMPASS**

installs in ALL newer cars ...EASILY

ONLY Hull's universal bracket permits easy mounting on upper or lower windshield moulding. Vacuum cup also included for windshield mounting. Fits any car of today or tomorrow. Compensates easier, reads easier. $5.50 and $6.95. At your dealer's, write for literature.

MOST-USED COMPASS OF MOTORISTS, BOATERS

HULL MFG. CO. P.O. Box 246-E-1, Warren, Ohio

ACTUAL SIZE 4¾ x 3½ x 3

# EXACT REPLICA ARMY GRENADE

## *(AS USED IN HAND COMBAT)*

Get a real bang when you toss this replica of an Army grenade. Startle ex-GI's. Explodes automatically 4 seconds after pulling pin as it strikes ground. Harmless. Real collectors item. Can't break. Heavy-gauge steel firing mechanism. Uses standard caps. Can be exploded over and over. Comes complete with throwing instructions. Send $1.98 plus 25c shipping charge—cash, check or money order.

**SATISFACTION GUARANTEED OR MONEY BACK**

MAIL COUPON TODAY

STANDARD AMERICAN SUPPLIERS, INC.
Dept. PS-1, 1 Park Avenue, New York 16, N. Y.

Rush ..... "Army Grenades." I enclose $..... ($1.98 plus 25c shipping charge for each.)

Name .....

Address ..... City ..... Zone ..... State .....

*(Advertisement)*

# OPPORTUNITIES

**special feature**

A number of one-man mail order enterprises are paying their owners an income of $40,000 to $50,000.

Mail order is big business. Annual catalog sales volume of Sears, Roebuck and Co. is over 700 million dollars!

## HOW TO START

# Your Own Mail Order Business

You can make a fortune by mail. New firms will set you up in a fabulous mail order business of your own! They'll make up your catalogs, prepare your advertising, supply mailing lists and even ship your products for you!

**By John Winkler**

When Arthur Johnson decided to earn some extra cash during his spare time he chose the mail order business because it could be run right from his own home. He reasoned that it was one of the few fields still open in which you could start your own business with a minimum of capital. In fact, his total investment was less than $100.00.

**Witness the success of Arthur Johnson. He obtained a franchise from Mail Order Associates and within three months the profits started pouring in.**

What began as a spare time job mushroomed into a profitable full-time business.

How successful was Johnson? Well, he drives a Cadillac convertible, owns a home in Nevada and a summer place in Florida, with a Chris-Craft cruiser to boot!

No, Johnson didn't find Uranium or answer the $64,000 question. He simply cashed in on the fabulous mail order business—with the help of one of the new mail order organizations which back enterprising newcomers to the mail order business.

Like so many other beginners in this field, Johnson was plagued with the problem of finding the 'ideal' mail order product. One that would have a large market, offer a good profit margin, bring repeat sales, and one which could be easily shipped by mail. After reading several books and courses on the subject, it seemed impossible. In order to obtain wholesale prices from manufacturers he had to purchase large quantities, which meant all his capital would be spent in inventory. The additional cost of sales letters and advertising and the risk of picking a poor mail order product and being stuck with all that merchandise made it even more obvious he'd have little chance of success.

Then he heard about Mail Order Associates of Maywood, New Jersey—an organization set up to aid the small mail order operator.

He wrote to M.O.A. for full information, sent in his application for a franchise and within three months the profits started pouring in.

Johnson attributes his success to the large selection of novel and unusual mail order products carried by M.O.A.

Mail Order Associates is one of the few new pioneers in the fabulous mail order business. One of the first organizations formed to put the small mail order operator in business—big business, they fill a definite need for the beginner with little capital. Here's what they offer you:

(1) Complete, ready-to-mail catalogs printed with your name and address . . . in any quantity you wish. Catalogs, sales letters or self mailers may be based on any of the following typical categories:

BABY GIFTS AND NOVELTIES
VITAMINS
INSTRUCTION BOOKLET and COURSES
COSMETICS

You select your own market.

(2) Profits range from 50% to 150% on most items. For example, you may sell a $20.00 mail order course and make $10.00 on each sale. Or you sell two appliances at a discount, give one away free and still make a 50% overall profit!

(3) Everything is drop-shipped for you. You have no merchandise to carry—no capital tied up in inventory. All merchandise is stocked and shipped for you by Mail Order Associates or the manufacturer. You forward orders and your own shipping labels to M.O.A. and all merchandise is sent direct to your customer—using YOUR OWN LABEL.

(4) Up to date mailing lists are made available to you. Lists of proven mail order buyers are compiled for the market you select. Records are kept so that no two distributors use the same names. All names are supplied on gummed labels—all you do is apply them to your catalogs.

(5) A consultation service is provided to answer any questions you may have. In addition, you're supplied with a list of leading national magazines that provide free editorial write-ups. You're even given form letters to use to obtain free advertising of your products from these magazines.

(6) Your choice of at least four new mail order programs during the year. One may be a catalog of baby items, another on household gadgets, etc. You may select one or as many as you can handle.

Here's how they operate: Unlike the individual mail order dealer who looks for the ideal product, M.O.A. searches the market first! After making surveys and tests to determine a profitable mail order market, they select the products to suit the market. For example, the market of selling baby items to new mothers is a big one. Over four million babies are born in the U. S. each year. This is the first step in selecting a mass market for their franchised dealers. Then comes the selection of products to suit this market. They contact every manufacturer of products sold to new mothers. From thousands of items offered by various companies, only those suit-

*(Advertisement)*

able for mail order are selected for preliminary tests. The final survey is made for new novelties and products not yet manufactured! If they feel certain ideas for new products have merit, they'll manufacture the items on a royalty basis and produce them for their dealers exclusively!

From this preliminary selection of new mail order products suited to this particular market, they make actual tests to see which items will sell and produce the greatest profit

The thrill of receiving money in your morning mail is one you'll never tire of.

for their franchised dealers. Having finally selected the best products they begin layout and artwork on a new mail order catalog for their dealers. The final catalog may consist of a small 6 x 9 brochure, a large 8½ x 11 illustrated booklet or even a small one page self-mailer, depending upon the market and selection of products. Sales letters are prepared by experienced copy writers, and the complete job—layout, copy and printing is done by experts to produce professional results.

By purchasing merchandise in large quantities and running catalogs on large presses, they are able to offer their dealers complete backing at a fraction of the cost the individual would have to pay for the same jab.

The final step is to supply the franchised dealers with names of prospective customers! In this particular example, they would make available the names and addresses of over 7000 new mothers every day!

Although many mail order firms use magazines and newspapers to advertise single items, the larger established firms have proven that direct mailings to prospective customers and previous mail order buyers is far more profitable.

A notice is then sent to all franchise holders explaining in detail the complete sales program for the particular market covered. The dealers then have the option to accept the offer or wait for a complete new sales program set up for a new market. At least four complete new sales programs are prepared by Mail Order Associates each year.

If the dealer decides to go ahead he may begin ordering catalogs (his personal name or business name is printed on all sales literature), and mailing them to his lists of prospective customers. As he receives orders for merchandise he simply forwards the orders together with addressed shipping labels to M.O.A. and they fill the orders and mail direct to his customers with the dealer's shipping label attached to each parcel. In some cases M.O.A. prepares a catalog of merchandise which manufacturers have agreed to drop-ship for the dealer. Mail Order Associates simply turns over the list of firms to the dealer and he works directly with the manufacturer. The customer pays the dealer the retail price of each item in the catalog. The dealer in turn pays M.O.A. or the manufacturer only the wholesale price of each item and pockets the difference—which really adds up when you mail a few hundred catalogs a week.

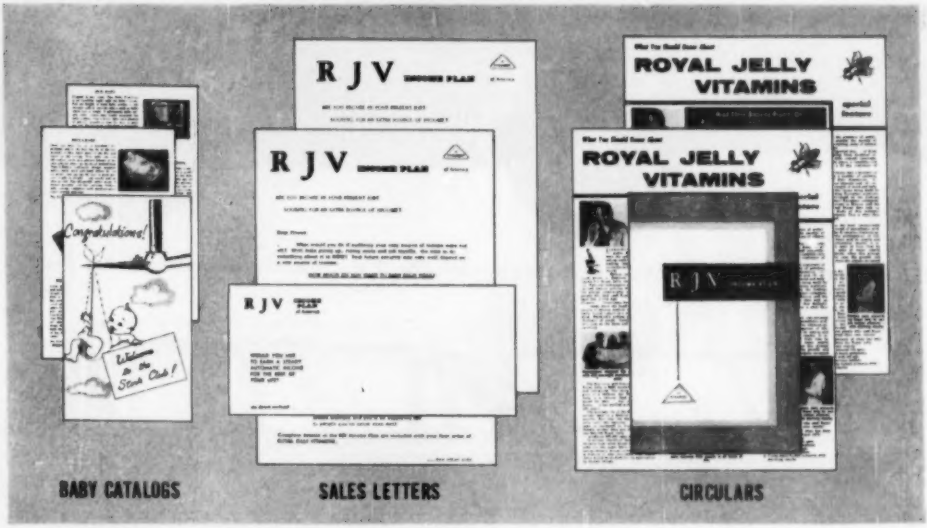
The operation of Mail Order Associates is based on a small margin or profit, but tremendous volume, which spells BIG PROFITS FOR ITS FRANCHISED DEALERS.

Mail Order, however, just as any other business, does involve a certain amount of risk. But the initial investment required is relatively small ($80 - $100) compared to other businesses. By eliminating the initial cost of stocking merchandise and preparing expensive catalogs, M.O.A. dealers can keep their initial investment to a bare minimum. On the other hand, few other occupations offer such exceptional income potential as a small specialized Mail Order business. The important thing to remember is that in Mail Order like everything else, the person who works hard and is not easily discouraged has a good chance of succeeding.

Big firms will carry all stock for you. They ship orders direct to your customers using your own shipping labels.

*(Advertisement)*

# Your OWN Catalogs of Top Mail Order Items!




**Mail Order Associates will prepare your catalogs, write your sales letters, supply mailing lists and even ship merchandise for you, using your own shipping labels!**

We don't say you'll be a mail order millionaire or another Sears & Roebuck, but if you're looking for a business of your own with a potential income of $50,000 per year the answer is mail order.

MAIL ORDER ASSOCIATES

Gilbert Turk, founder of Mail Order Associates, is certainly well qualified to head such an organization. Formerly president of two large mail order companies, his articles on selling by mail have appeared in national magazines throughout the country. He has sold everything from build-it-yourself plans to name brand appliances. When the paint-by-numbers fad was sweeping the country, he invented a three dimensional paint set which sold like wildfire. With Turk, Mail Order is almost an obsession. He thinks, talks and lives it.

Firmly convinced that no other business offers the tremendous opportunities of mail order he is an outspoken advocate of the man or woman who wants to start in business for himself. As Turk puts it, "By all means, start your own business and start TODAY! If you want security, independence and a chance to hit the jackpot, make your choice Mail Order. There's nothing like it. Absolutely nothing!"

## FOR FREE DETAILS

**Mail coupon below today**

**Mr. Gilbert Turk, Pres.**
**MAIL ORDER ASSOCIATES**
**Dept. PS-86, 130 W. Pleasant Ave., Maywood 86, N. J.**

Dear Mr. Turk:

The co-operative dealer franchise plan with Mail Order Associates sounds exactly like the kind of lifetime business of my own I want to establish. Please send me complete FREE details on how I can get my own franchised dealership.

NAME .....

ADDRESS .....

CITY ..... ZONE ..... STATE .....

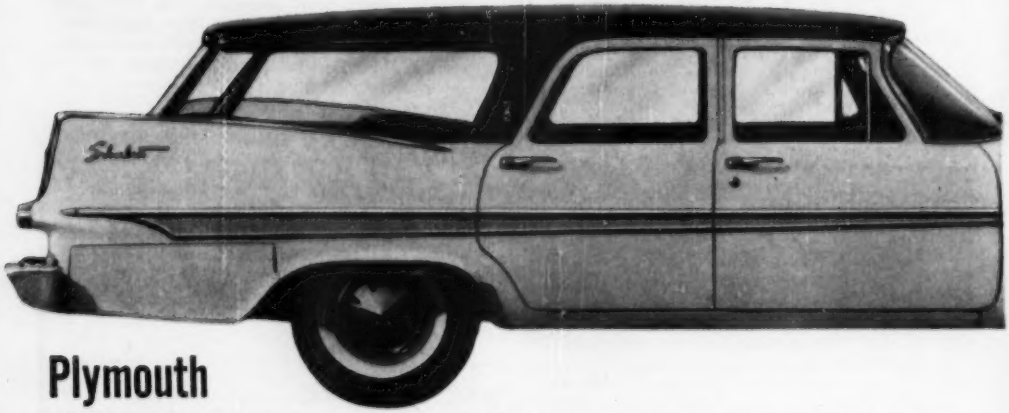
*(Advertisement)*

## Ford

Concealed pillars and slanting door frames give the Ford, like its competitors, the look

## Chevrolet

Chevrolet stylists, for the first time, have succeeded in giving their wagons that sedan



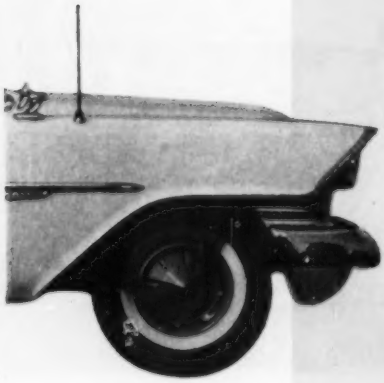
## Plymouth

Exceedingly popular last year, Plymouth is offering the industry's biggest wagon choice

POPULAR SCIENCE Monthly

of a sleek hardtop.

look at the rear.



—10 different models.

## Sizing up the

# New Wagons

***More than ever like family sedans, they are loaded with everything—including extra air conditioning for rear seats***

**By Devon Francis**

FELLOW we know in Detroit telephoned the zoo there the other day and said, "You got a hippopotamus I can borrow?"

The guy at the zoo said suspiciously, "What you want a hippo for?"

The first guy said, "To put in a station wagon."

Well, as you no doubt can guess, the guy with the station wagon was a publicity man for an automobile manufacturer. He wanted to show that his wagon would tote a hippo. There are absolutely no lengths that a motormaker won't go to in making his product look good, especially if it's a station wagon.

There's good reason. The new crop of station wagons is bigger and more gorgeous—and evidently more popular—than ever. Every seventh car coming off Detroit's assembly lines these days is a wagon, and there are perfectly sane people in that town who think that by the end of the year that's going to jump to every sixth car.

You can even get wagons, now, that have a special air-conditioning unit for second- and third-seat passengers. In an increasing number, you no longer have to pull out that third seat for cargo duty and store it in the garage—the seat just

disappears into the floor. There are fewer transoms and more roll-down windows. There are even—no kidding—rear radio speakers controlled from switches handy to the third seat.

Chevrolet, Ford and Plymouth, of course, sell the bulk of the wagons; and when the returns are in from the outlying precincts, 1958 sales probably will have amounted to 650,000 vehicles. That's pretty hot in a year when sales of automobiles as a whole were skimpy.

***Dimensions.*** First, there's the size of the things. Half of all the '59 wagons are bigger, and that includes Chevy and Ford. Plymouth, already that way, stands pat. The new wagons carry more—if not in actual pounds, at least in bulk. That's true of Chevy and Ford.

Chevy's rear-opening height is down 3.5 inches, Ford's .5 of an inch. Chevy's rear-opening width is down .5 of an inch, Ford's .4. Chevy's cargo compartment length is up a whopping 15.1 inches, Ford's 7.7. Chevy's distance between wheel housings is down .5 of an inch, Ford's up 3.9 inches. Chevy's tailgate height is up 1.2 inches, Ford's down 1.7 inches. Plymouth? It's standing pat on inside dimensions, too.

***Suspensions.*** They're softer for all three cars. That's to give a "sedan ride" to a wagon. But it's a less-than-happy solution if you're going to transport a refrigerator, or bags of cement for a wading pool.

Ford simply accepts the penalty of fewer pounds in capacity, or offers the buyer a stiffer ride with optional heavy-duty springs and shocks. Chevrolet gives the buyer a chance to level the rear end with air springs all around, at $135. Plymouth offers optional rear-only air springs at $106. The latter are not air springs in the accepted sense. They are car-leveling air bags that come into play only when the rear steel springs get overburdened.

***Squeaks.*** All the wagon makers are concentrating on eliminating noise. Time was when a wagon's squeaks were mostly in the body. Open back ends destroyed the rigidity of the box that was the body, and vibration inevitably loosened joints. Bracing mended most of that.

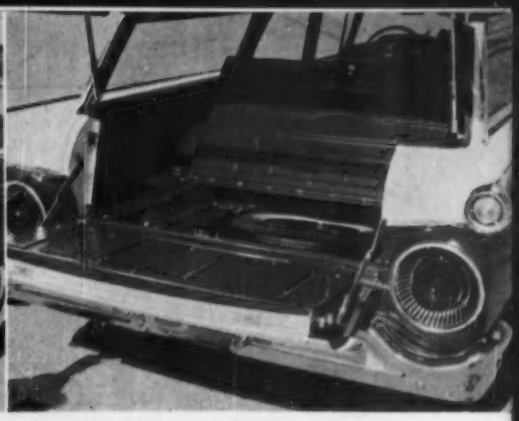
Squeaks do remain. They're mostly in the internal hardware—in seats, for example. Better anchorages are helping. Plymouth, for one, now has positive latches

**Ford** AN INCH LOWER, over-all, Ford wagon is heavily insulated against sound, heat.

**Chevrolet** LOWER BY 2½ INCHES, Chevy has longest cargo compartment.

**Plymouth** RUBBER PADS protect tailgate's finish as it rests on bumper.

**CUT FARTHER INTO ROOF,** the transom has cabinet-lid type of catch for one-hand operation.

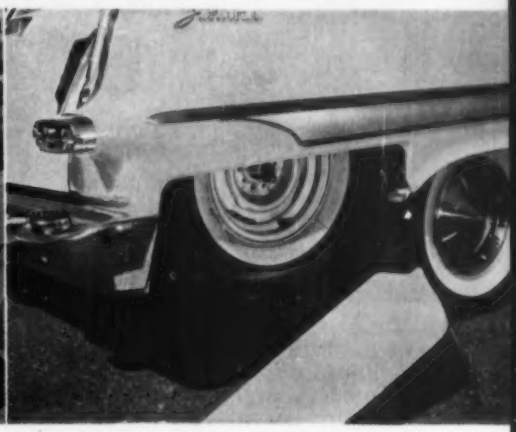


**COUNTERBALANCED TAILGATE** now lies flatter in the open position to make loading easier.

**REAR WINDOW** can be lowered by hand or—if powered—by key from here or driver's seat.

**CARGO FLOOR** of nine-passenger wagon is formed by bottom and back of third seat.

**REAR-FACING PASSENGERS** in wagon's third seat can be cooled by an auxiliary air conditioner.



**SPARE WHEEL AND TIRE,** carried outside, are reached by removing special fender panel.

STUDEBAKER

AMBASSADOR

## ...and a dozen other new U.S. wagons

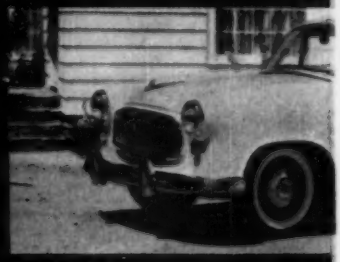
CHRYSLER

BUICK

MERCURY

RAMBLER

EDSEL



AMERICAN

for the back of the second seat instead of spring-loaded friction catches.

Now let's go back to the dimensions. The places where they have been altered for '59 are a clue to the reason for them —high style. They're a result of the pulling and hauling between the stylists—who are under pressure from the sales departments—and the design engineers.

The people who buy wagons run to two extremes—house painters on the one hand, the "station-wagon set" on the other.

The house painters want lots of cargo room, big rear openings, stiff springs and truck-sturdy interiors. The station-wagon set wants lowness, quietness, beauty, comfort, lots of glass.

***The rearward-facing seat.*** New in the Chevy, two years old in the Plymouth, the turned-around third seat is partly style, partly convenience, partly engineering necessity. Ford parts company here.

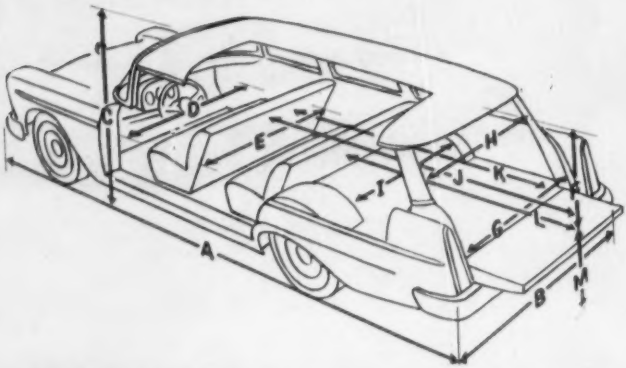
Ford's research people say most wagon occupants want to face forward. They

say that at night the headlights of a following car stab the eyes of rearward facing passengers. They say rearward seats are hard to climb into. They say rearward seats necessitate a roll-down rear window for ventilation, which requires a high tailgate to accept the window, which reduces the driver's rear visibility. They say Chevy *had* to go to a rearward-facing seat because its X frame provided no foot room for a forward-facing one. (That wasn't true, of course, for Plymouth, which has no X frame except in its convertible. Plymouth marketing people just liked the idea.)

Chevrolet and Plymouth alike will give you all sorts of reasons for the rear-facing seat. Item: Kids use it most, and they can climb anywhere. Item: It's a safety factor in a front-end collision. Item: It simplifies storing the third seat under the floor—Ford stores only the seat springs, not the cushions.

***That spare tire.*** Disagreement also occurs on carriage of the spare. Plymouth

[*Continued on page 238*]




**SPECIFICATIONS** of 15 wagons given in the table are for four-door, six-passenger models with one exception—the two-door Rambler American. Cargo volume specified is total air space, much of which obviously is not usable—unless you carry loose sand around. All figures are inches; except volume, which is given in cubic feet.

| How the Wagons Compare | OVERALL DIMENSIONS | | | HIP ROOM | | CARGO SPACE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Length (A) | Width (B) | Height (C) | Front (D) | Rear (E) | Height of Rear Opening (F) | Floor Width of Opening (G) | Maximum Opening Above Tailgate (H) | Width Between Wheelhouses (I) | Length, Front Seat to End of Gate (J) | Length, Front Seat to Closed Gate (K) | Length, Second Seat to End of Gate (L) | Loading Height of Tailgate (M) | Cargo-Space Volume (cu. ft.) |
| BUICK | 217.4 | 80.7 | 57.1 | 65.4 | 65.4 | 25.2 | 50.5 | 45.4 | 39 | 123.1 | 94.4 | 90.2 | 27.7 | 75.7 |
| CHEVROLET | 210.9 | 79.9 | 56 | 66.1 | 66 | 26.7 | 47.6 | 44.6 | 46.4 | 120.1 | 94.8 | 85.3 | 27.3 | 92 |
| CHRYSLER | 220.1 | 79.5 | 57.8 | 63 | 62.7 | 28.5 | 46 | 48 | 45.7 | 119.7 | 98.6 | 85.6 | 27.6 | 95 |
| DE SOTO | 216.1 | 78.7 | 57.1 | 63 | 62.7 | 28.5 | 46 | 48 | 45.7 | 119.7 | 98.6 | 85.6 | 27.5 | 95 |
| DODGE | 216.4 | 80 | 57.1 | 63 | 62.7 | 28.5 | 46 | 48 | 45.7 | 119.7 | 98.6 | 85.6 | 27.5 | 95 |
| EDSEL | 210.1 | 79.8 | 57.8 | 60.4 | 60.7 | 27.5 | 57.6 | 61.7 | 42 | 116.1 | 94.3 | 79.9 | 25.6 | 92.1 |
| FORD | 208 | 76.6 | 56 | 60.4 | 60.8 | 30 | 44.3 | 55.4 | 45.9 | 115.3 | 94.4 | 79.1 | 25.2 | 92.1 |
| MERCURY | 218.6 | 80.7 | 57.8 | 62.5 | 62.8 | 24.2 | 48.1 | 46.3 | 44.2 | 123.4 | 99.9 | 84.7 | 26.2 | 101.1 |
| OLDSMOBILE | 218.4 | 80.8 | 56 | 66.1 | 65.5 | 22.6 | 50.5 | 45.1 | 45.1 | 122.9 | 91.6 | 97.9 | 27.4 | 72.8 |
| PLYMOUTH | 214.5 | 78 | 56.9 | 63 | 62.7 | 28.6 | 46 | 48 | 45.7 | 119.7 | 98.6 | 85.6 | 27.2 | 95 |
| PONTIAC | 214.3 | 80.7 | 56.3 | 65.4 | 65.4 | 26.8 | 48 | 45.3 | 46.2 | 119.1 | 93.6 | 83.7 | 23.5 | 92 |
| RAMBLER | 193.6 | 72.2 | 58.6 | 59.8 | 60.1 | 24.5 | 50.8 | 47.8 | 43.1 | 104.7 | 82.4 | 70.9 | 25.9 | 80 |
| RAMBLER Ambassador | 202.6 | 72.2 | 58.2 | 59.8 | 60.1 | 24.5 | 50.8 | 47.8 | 43.1 | 104.7 | 82.4 | 70.9 | 25 | 80 |
| RAMBLER American | 178.3 | 73 | 58.2 | 58 | 45.2 | 26.4 | 39.3 | 38.4 | 40.6 | 84.3 | 68.3 | 53.9 | 25.6 | 52 |
| STUDEBAKER Lark | 184.5 | 69 | 58.7 | 56.5 | 59 | 30.2 | 45 | 40 | 42 | 92 | 82.5 | 67 | 26.6 | 65 |

**A Popular Science Annual Report:**

# A Safety Expert looks at the '59 cars

***With a few notable exceptions, the '59s are no safer than last year's. Despite rumbling from lawmakers, Detroit is marking time***

**By Paul W. Kearney**

Author of *How to Drive Better* and *I Drive the Turnpikes*

*Padded steering wheel is a safety option on new Chrysler models.*

CRASH-PROOF design seems to have reached the tread-water stage in Detroit's 1959 offerings.

With but three exceptions, there have been no significant additions to the "safety package." These exceptions are:

1. Chrysler Corporation's optional padded steering-wheel spoke. This is a further improvement on the "deep-dish" safety wheel. Unfortunately, this year's trend otherwise is to chrome-plate the spoke, converting it, in case of a smash-up, into a classy-looking hara-kiri knife.

2. Studebaker Lark's crash padding on the lower edge of the dash. In other cars this metal area can still mutilate the knees and shins of front-seat riders, even in just a panic-braking stop. (Mercury's approach has been to move the dash a full six inches farther forward, away from the knees.)

*Crash padding under dash protects knees, shins of Lark riders.*

3. American Motors' optional headrest for driver and front-seat passenger. Advocated in these columns last year, this is a much-needed safeguard in rear-end collisions, with their risk of the dreaded whiplash neck injury.

*Headrest, American Motors option, cuts whiplash-injury risk.*

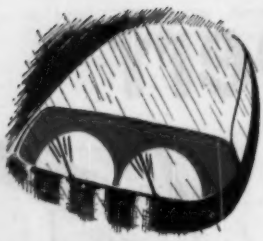
It is noteworthy that two of these Oscars go to the lowest-priced American-made cars.

Except where pushbuttons are used, window cranks and door handles remain an almost universal threat to kneecaps on all but the highest-priced cars and Mercury. Crash padding on the back of the front seat is conspicuous by its absence: Of 20 models examined, I found it on none. And

**"There is no earthly reason for not making compulsory**

wiper coverage is still sadly inadequate on the vast side areas of the huge 1959 windshields.

Eggshell roofs predominate in the entire field. Finally, the stylists have gone berserk in the cockpits; there's a rash of jukebox glitter and shine, about as refined as a mouthful of gold teeth. A far more serious indictment than tastelessness: This excessive volume of brightwork will be no fun to look past when the sun is pouring through the glass. This year Dodge and De Soto rival Pontiac for the dubious distinction of having the most garish instrument panels.



*"Wiper coverage is still sadly inadequate on the vast side areas of 1959 windshields."*

***Thunder over Detroit?*** Meanwhile, Detroit seems oblivious to rumblings in the atmosphere. Last fall, Rep. Kenneth A. Roberts, chairman of the Congressional special subcommittee on traffic safety, reported to the 1958 Governors' Traffic Safety Conference: "I was not long in becoming convinced, on the basis of the evidence we had seen, that Detroit was not turning out the safest possible product." As a consequence, he has introduced a bill to require every motor vehicle to meet safety requirements to be established by the Bureau of Standards. Certainly if safety glass or turn indicators can be made mandatory, there is no earthly reason for not making compulsory such a valuable feature as complete crash padding, still largely an option.

There's a rumble from another quarter, too. New York's Traffic Safety Policy Coordination Committee recently reported that it was not convinced that auto makers are seriously trying to design safer cars, and suggested that government regulation of the industry may become necessary. It recommended that the National Safety Council issue a safety-rating report card on each new car produced.

In response to such omens, automobile spokesmen continue to make speeches about spending $1,500,000 a year on grants for outside safety research, over and above their own individual outlays in this field. Surveying the '59 models, one wonders where the money goes!

This is not to imply that the safety potential of the new cars isn't superior to that of cars made four or five years ago. It is simply that, beyond the basic field of automotive engineering, product safety is not second nature in Detroit; it is still an afterthought.

*"A rash of jukebox glitter and shine . . . No fun to look past when the sun pours through the glass."*

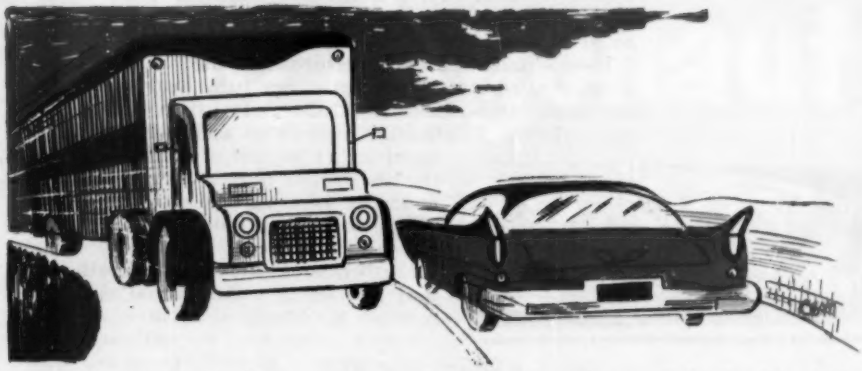
***Lower and wider.*** The continued trend to lower silhouettes is not only irrational from the standpoint of comfort; more important, it aggravates the driving hazard of the unseen car approaching out of a slight dip in the road. The result will doubtless be an increase in the ratio of head-on collisions and opposing sideswipes, already second only to the single-car rollover as a rural-road killer.

Likewise, the trend to wider bodies on the same old obsolete roads is a serious trouble breeder. In a very few years some cars have fattened from around 77 inches to 81 inches. Yet we still have hundreds of thousands of miles of undivided driving lanes that are 96 inches or narrower per lane, many posted for 60 or 65 m.p.h. limits. Passing a



sleepy drivers on the spacious turnpikes, we still have to

***such a valuable feature as complete crash padding"***



fast-moving tractor-trailer roaring toward you around a curve, with a safety margin of 15 inches or less, is not what the doctor ordered for the weekend drivers who dominate our highways.

*"The trend to wider bodies is a trouble breeder . . . Passing a tractor-trailer roaring toward you around a curve, with a safety margin of 15 inches or less, is not what the doctor ordered for the weekend drivers who dominate our highways."*

Detroit's stock retort, of course, is, "Modernize the roads." Unfortunately, we can't stamp roads out of sheet metal, like cars. And automotive engineers seem to have forgotten what the highway engineers have known for years: that the faster cars travel, the more elbow room they need for the same body width. Thus it has been repeatedly demonstrated that an 18-foot, two-lane road will have twice the number of accidents as a 20-foot road carrying equal traffic. So giving us faster cars for roads that have not yet been widened proportionately makes it seem even more premature to widen the cars.

Furthermore, despite all the study that has been given to the causes of crash injuries—as distinguished from the causes of crashes—it seems ironic that the whole industry has tacitly ignored a factor of mounting importance: the rollover. Even Cornell's Crash Injury Research project has been sidestepping this issue. The most costly '59 model you can buy wouldn't be admitted to any legitimate stock-car race in the country until you had a roll bar installed to keep the roof off your neck in case of a turnover.

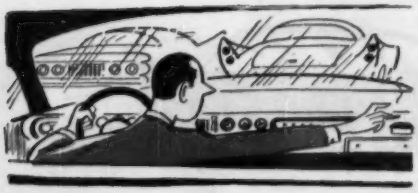
Yet Detroit figures that these eggshell roofs are perfectly safe for you and your family—while the public, it is true, is sucker enough to encourage the designers by demanding more and more "four-door hardtops" with less and less overhead protection.

***The rollover debate.*** The argument that you don't intend to roll over, and are protected anyway by lowered centers of gravity, is specious in view of accident records. The excessively high proportion of one-car mishaps on our fast turnpikes is disturbing. For while the National Safety Council reports that single-car crackups account for 33 percent of all accidents on rural public roads, the average for the turnpikes in New York, Pennsylvania and Oklahoma is 59 percent and the Kansas Turnpike has just released a report of 86 percent for a nine-month period! In charging the difference to the higher speeds and the prevalence of

*"The part-time land pilot is buried behind an instrument panel almost as complicated as a bomber's."*

sleepy drivers on the spacious turnpikes, we still have to remember their better engineering—lack of sharp curves, steep grades and cross traffic, hazards that make it far easier to go off a narrower public road.

Even eliminating the superhighways, the National Safety Council attributes 43 percent of our rural-road fatalities to the single-car accident, of which no less than 21.6 percent are rollovers. Discounting pedestrian accidents, which account for 11 percent of the rural deaths, the true ratio of turnover fatalities among motorists becomes 24 percent—a very substantial figure indeed for nonracing drivers.



*"Fallacy of locating controls or ash tray or glove compartment where the driver can barely reach them."*

Furthermore, in rollovers, deaths exceed injuries by a substantial margin—contrary to virtually every other accident category except head-on collisions. This in itself is a further indictment of Detroit's bland disregard of a major problem, and one that is not solved by impact-resistant door latches. Invaluable as these latches are in most other crackups, they mean little in a rollover.

***Cockpit glamour.*** Finally, it would appear that a very little part of the $1,500,000 safety-research grants has gone into serious study of automobile cockpits—the place where the harried driver should be able to work without let or hindrance. So the stylists (Heaven forbid that any engineer had anything to do with it!) have buried this part-time land pilot behind an instrument panel that seems almost as complicated as a bomber's, and sports enough razzle-dazzle to induce vertigo. Only in the cheapest models, generally, can you get a panel that is as simple, forthright and functional as the ones in sports cars. The worst offenders are the so-called "medium-priced" lines, where a dizzy panel supposedly makes the owner feel that he is driving in the next higher prestige bracket.

In addition, most cars sold today have automatic transmissions, giving the stylists a new area in which to add confusion. Last year there were 12 different abbreviations or symbols used to indicate the shift positions on the quadrant. General Motors alone had seven different ones, with Buick boasting of two different sequences. Pushbutton transmissions further complicate the problem—although this year both Edsel and Mercury have abandoned them in favor of the familiar lever.

*"Feet pinned beneath front seat structure . . . a serious confinement in case of accident."*

Finding the so-called "emergency" or parking brake (and its release) each year becomes more and more of a game. Three times I've had the hood of my car spring open on the road because some parking-lot attendant had mistaken the hood release for the parking-brake release just above it.

At best, these needless complexities are breeders of property damage when somebody else has to handle your car. At worst, they introduce the driving hazards of hesitation or outright error in an emergency. There is no excuse for this in a 300-hp. era that is witnessing a repetition of newspaper accounts of cars "going out of control," mounting the curb and felling pedestrians like tenpins while the hapless driver is merely trying to park or unpark.

[*Continued on page 230*]

# The Argonaut

## $25,000 Super Car

Biggest Argonaut is the 21½-foot "State Limousine," an eight-passenger model costing $26,993.

***Designed to last a lifetime, these cars will be hand-built at a 500-a-year rate—chassis in the U. S., body in Italy***

SUPPOSE you were a millionaire whose aim was to build and sell the world's finest automobile, regardless of cost. What would such a car be like?

Richard Luntz, 39-year-old Cleveland industrialist, has an answer. He told a team of automotive designers to draw up plans for "the finest, most beautiful, best engineered, best powered, most comfortable, most carefully constructed and longest-lasting automobile possible."

Two months from now the Argonaut, first car made from those designs, will be road-ready. It has:

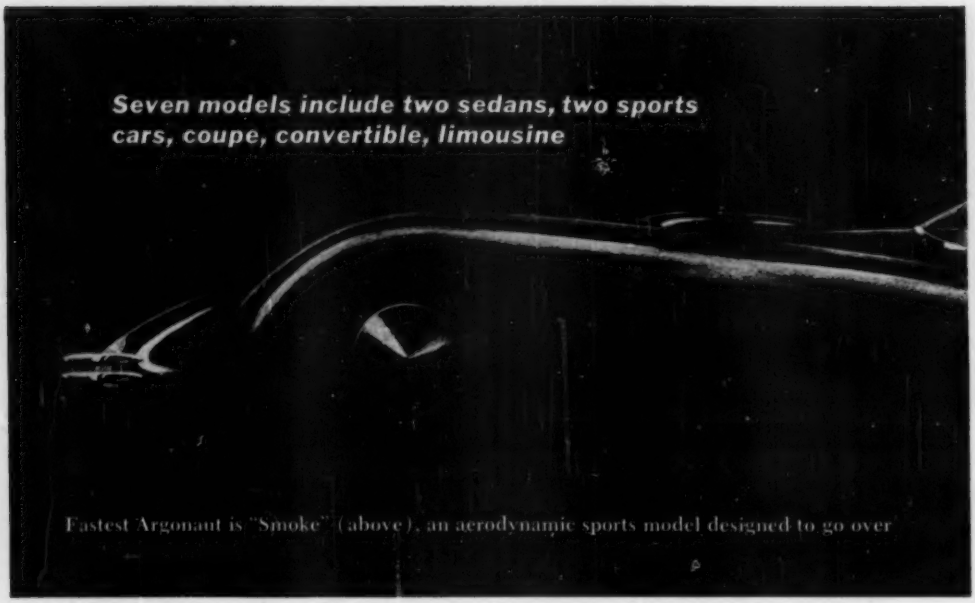
- A tubular steel frame of high strength, and the lowest center of gravity and widest tread of any passenger car.
- A handmade aluminum body.
- A specially built V-8 engine.
- Durable, corrosion-resistant parts.
- Seven models, sports car to limousine ($22,700 to $26,993).

***The Argonaut's V-8*** is a modified Chrysler marine engine. Horsepower is a secret—to enhance the car's "dignity." But it's described as the most powerful ever mounted in a passenger car.

Two 12-volt batteries are connected to a high-output generator that balances full load at idling speed. Aircraft wiring is used throughout. Two electric fuel pumps supply dual carburetors from a 32-gallon tank. Transmission options include automatic or manual with overdrive.

***Chassis*** come with a 154″ wheelbase for the "state limousine," 126½″ for other models. Frame members are five-inch-diameter cold-drawn seamless steel tubing with a 3/16″ wall thickness.

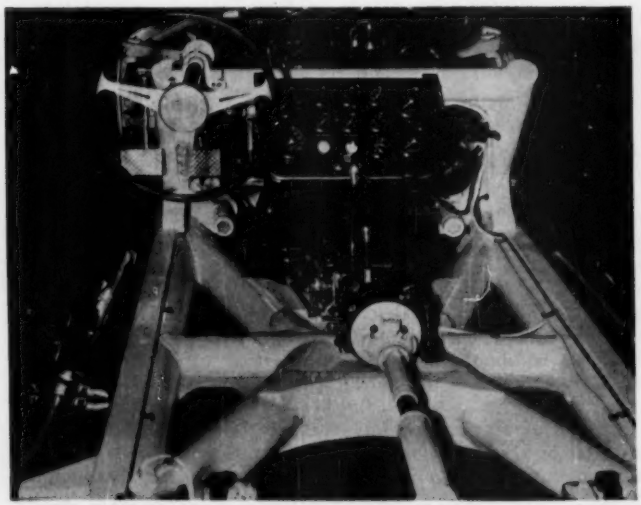
Front-end suspension is by torsion bars,



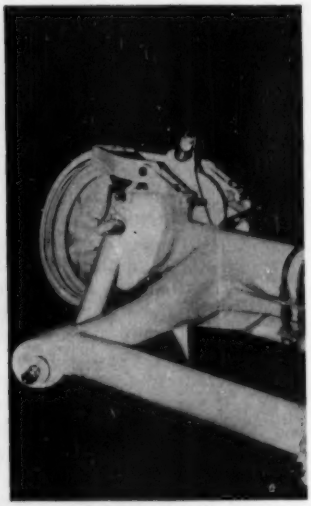

with low-frequency semi-elliptic springs in the rear. Front and rear shock absorbers are individually adjustable from the dash.

***Extra-large brake drums*** have brake linings of sintered iron. Twin-stage master brake cylinders give the effect of power brakes, without a power assist.

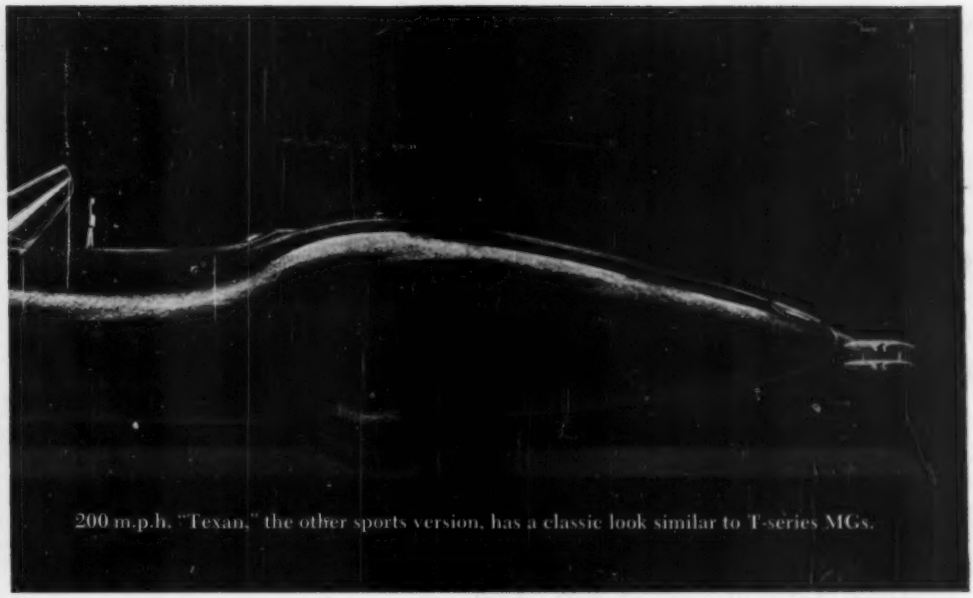
***Racing tires*** carry 35 pounds minimum pressure. Firestone Super Sports, 8.20-by-15, are used on all models but the limou-



**MASSIVE FRAME** of three times normal strength rides extremely low, giving car the lowest possible center of gravity. Drive shaft and rear axle pass over the frame; dual mufflers lie alongside it.



**TWO RADIATORS** of brass and stainless nestle between front-end members.

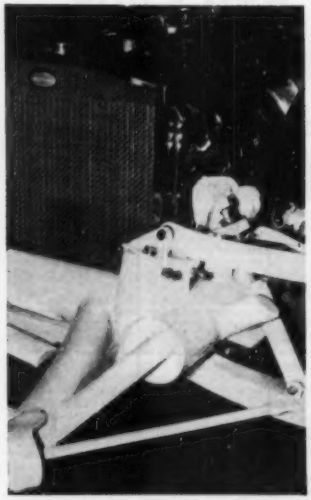


200 m.p.h. "Texan," the other sports version, has a classic look similar to T-series MGs.

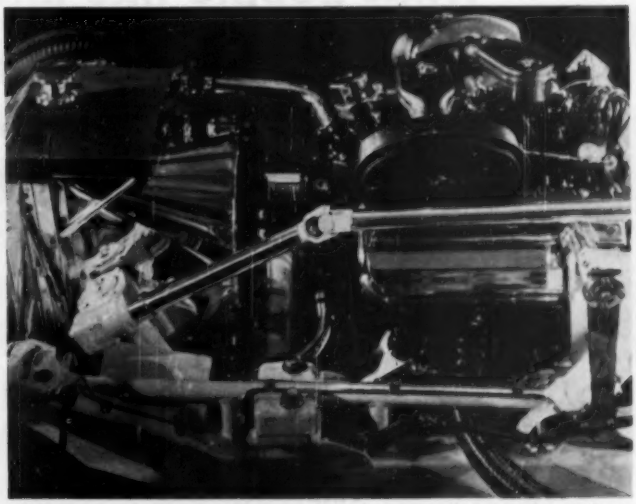
sine, which rolls on bigger 8.90-by-15s.

Each Argonaut chassis is shipped to Italy to be fitted with hand-crafted aluminum bodies by Touring or Bertone.

So many options and extras are possible —swivel seats, TV, running water, air conditioning, bar, refrigerator and a compact office—that each car must be made to order. Waiting time: seven to nine months.—*Herm David.*



Small one cools oil, big one water. Brake-drum flanges project out into airstream.



**ENGINE AND CHASSIS PARTS** are polished or enameled. Fan hood (left) is brass. Steering shaft, rocker-arm cover, mufflers with connecting pipes, brake and fuel lines are all of stainless steel. END



*What's your prediction for sales?* *Which leaves you absolutely cold?*

# What You Think of the '59s

***PS survey reveals sharp disagreement on "good" and "bad" points, yet many people plan to buy—and even have the make picked out***

A CROSS section of POPULAR SCIENCE readers, polled soon after the new cars went on public display, expects 1959 to be the successful sales year Detroit is hoping for.

But that doesn't mean they all like the new models. Only 42 percent rated the '59s better than last year's. About 29 percent considered them the same. And 28 percent said they were worse!

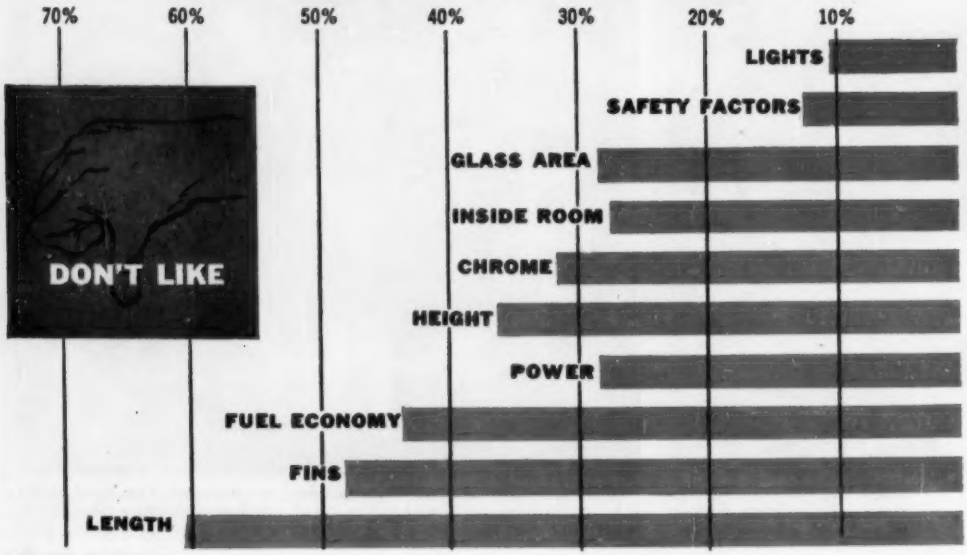
POPULAR SCIENCE surveyed 5,000 readers coast-to-coast, asking what they thought of the '59 cars and what they expected the public's reaction to be. Their responses reveal that opinion is sharply split: Many people like what others dislike. Their contradicting views mirror the split in Detroit, where the three major manufacturers push on with bigger-than-ever dreamboats while the two independents are off on an economy kick.

Here are some of the survey results in detail:

***Are you thinking of buying a '59 car?***

***Yes—22%***

## What people like and don't like



### *What's your prediction for sales?*

***Better than last year—47%***
***Same—36%***
***Worse—18%***

If anything like that 22 percent intending-to-buy readers actually do buy, the car business will exceed the wildest dreams of Detroit sales managers. And notice this: More people thought sales would be better than said they liked the cars, and far fewer thought sales would be worse than said they disliked the cars. Detroit's motive-probers will chortle over that finding: It suggests that many people secretly approve of the '59 models, consider it unfashionable to admit it, and transfer their own approval to their neighbors ("sales will be better").

### *Which car is the best looking?*

***Chevrolet—15%***
***Ford—15%***
***Pontiac—15%***
***Buick—15%***

### *Which is the most impressive?*

***Chevrolet—16%***
***Buick—15%***
***Cadillac—15%***

### *Which leaves you absolutely cold?*

***Chevrolet—19%***
***Ford—18%***

There the split in public opinion shows clearly. GM blew millions on its new, *new*, NEW line. Ford spent less, but only slightly less, for changes that most people don't notice.

There's no doubt that GM's radical restyling had impact. Everyone recognized it as new and impressive. Lots of people liked it—very much. But just as many didn't—they felt more comfortable with lesser changes.

The readers' own comments make this controversy apparent:

Ford—"Just a warmed-over '57."

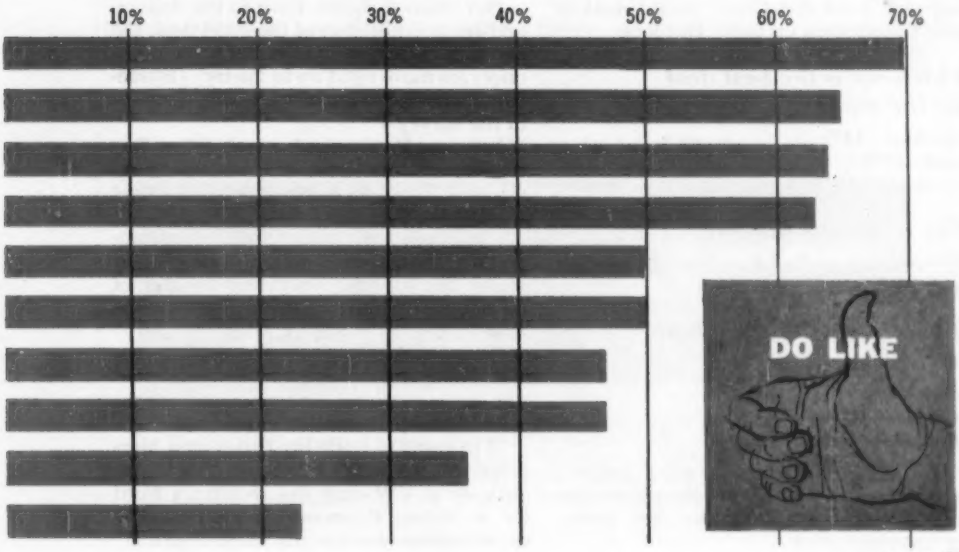
Chevy—"These designs are too severe."

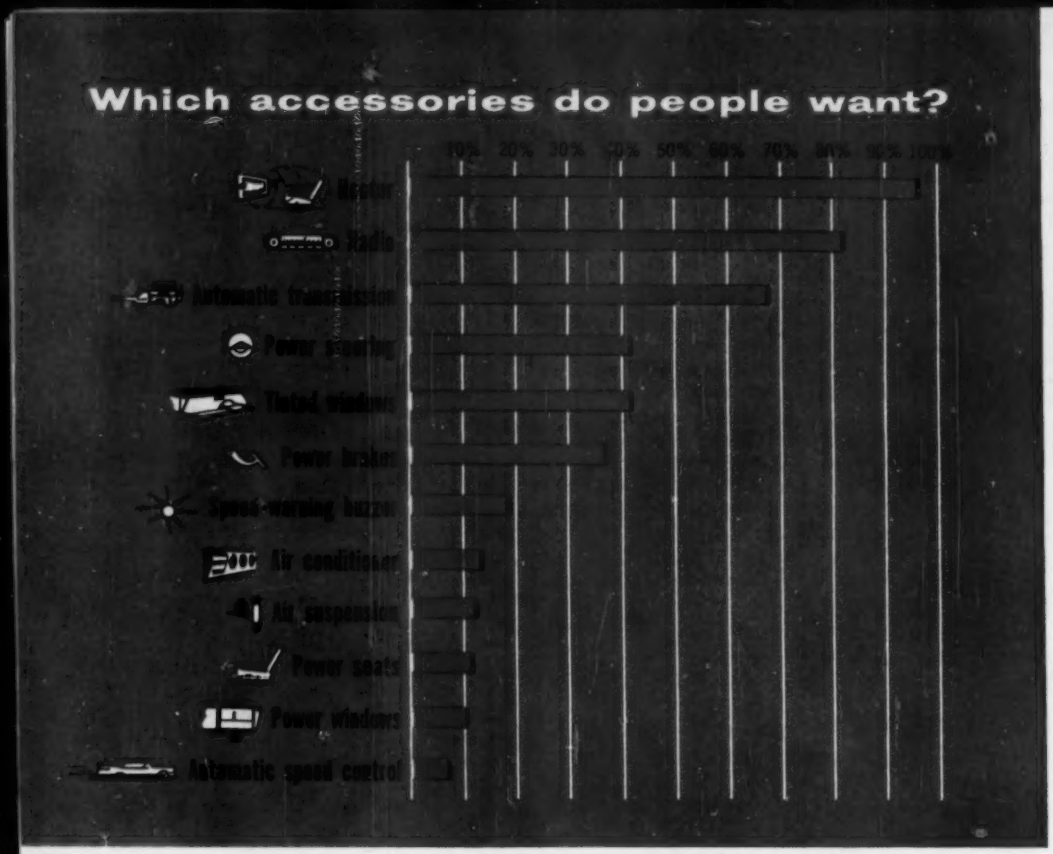
Another man wrote: "They're all ridiculous. Buick looks like a surfboard, Olds like a football helmet. Dodge looks like it stepped out of a British cartoon satirizing American autos."

And a Baton Rouge electrician may have summed it up for them when he said: "What Detroit doesn't know is that people are tired of change. People want to relax again with an auto that is the same and dependable."

If everybody bought cars strictly on ap-

**about the '59s**






pearance, Ford and Chevy would seem to have things sewn up tight. But look:

### *Which car is the best deal for the money?*

***Rambler—34%***
***Ford—22%***
***Chevrolet—18%***

### *Why do you think so?*

***Of those who picked Rambler, 46 percent said: economy.***

### *If you buy a '59, which one will you pick?*

***Ford—17%***
***Rambler—16%***
***Chevrolet—16%***

Here the increasing swing toward smaller cars shows up. People admire the jazzy dreamboats. They like their looks, the impressiveness.

But when it comes down to the dollars-and-cents evaluation of the good deal, the decision on a final choice, then the economy cars move right up to the top. (Studebaker's Lark was too new for consideration in the survey.)

Informed comment came from one reader, a Bloomington, Ill., consulting engineer working for a firm that runs a fleet of cars. He said:

"Our company records covering hundreds of thousands of miles prove without doubt the superior operating savings of Rambler . . . best American buy on the road today."

Many readers intend to buy foreign cars (one-third of those picked VW). Included was one man whose concern over economy seemed mainly a matter of principle:

"I'm going to trade my Buick on a Mercedes 180, my wife's Plymouth on a Plymouth—or a VW—and the children's Ford for a Volvo. Economy—workmanship—maintenance—are forcing us to imports."

And other readers, people who are *not* buying cars this year, add their weight to the same argument.

### *If you're not planning to buy a '59, why?*

***Satisfied with the old one—38%***
***Prices are too high—35%***
***Waiting for Detroit's small car—14%***
***Don't like the '59s—13%***

Again, the need to save money shows up, holding people back. (That satisfied-with-the-old-one answer is sometimes a face-saving euphemism for lack of dough.)

They want small cars then? Hold on. Shorter, yes. Finless, yes. The big beefs against the '59s are length and fins (see chart on previous page). But the other marks of Detroit's gaudy chariots are still in demand.

- Big interiors. ("I don't give a hoot about the size of the trunk, but I do want leg room," wrote a Baton Rouge chemical engineer.)
- Wide window areas. (Although many readers echoed the Houston engineer who said, "I can see no point in the wrap-over windshields. I don't watch airplanes when I drive.")
- Powerful engines. (Caustic digs about the impotent imports were frequent.)

The split in public taste shows up clearest when it comes to fuel economy. Everybody has an opinion, and a decided one. Half the voters don't mind the gas appetite of new models. Just as many readers dislike it.

It looks as if the public wants to have its cake and eat it too: powerful, roomy cars bedecked with glass and chrome, but more compact and—maybe—more economical.

Well, what they really want are *cheaper* cars. Sure. But they don't seem ready to give up the fancy fixings that make the '59s cost so much.

### *If you were going to buy a '59, which accessories would you pick?*

***Heater—96%***
***Radio—82%***
***Automatic transmission—68%***

Just add up those three. You see that two people out of three would run the bill for a Ford, Chevy or Plymouth up over $2,600, 14 percent higher than the same car stripped.

But that's not all. Lots of readers (13 percent) want air conditioning. And some would shoot the works—see chart at left. Loading a car like that adds a good $1,000 to its stripped price.

That leaves the public split, just as the auto makers are. Maybe it's a good thing. People had been griping: All cars are alike. You can't say that anymore.

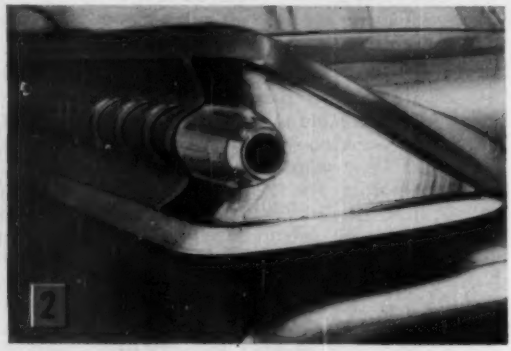
This year there are elaborate cars, simple cars, big cars, little cars, and a couple in-between. Everybody can get what he wants. END

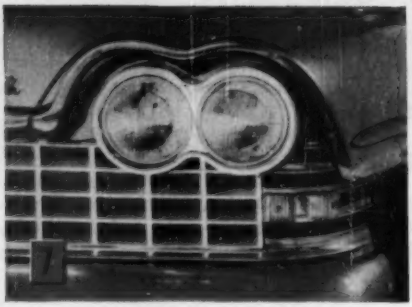
### Ford's New Galaxie Borrows Thunderbird Style

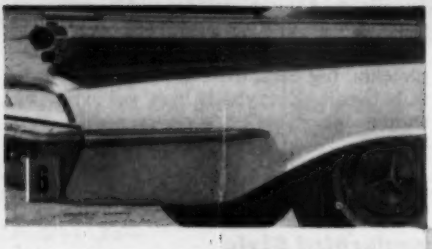
FORD swiped the clean, boxlike roof off its Thunderbird, dropped it onto the regular Ford chassis, and came up last month with a new top-of-the-line series: the Galaxie. Originally, the new design was to have been saved for 1960. Galaxie is mechanically the same as the other '59 Fords. It costs about $50 more than the Fairlane 500 (the Galaxie four-door sedan is $2,700 at the factory).

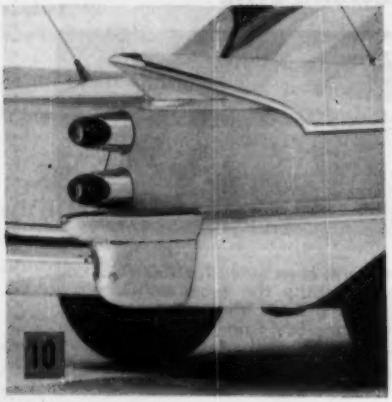
# What 1959 Car Are

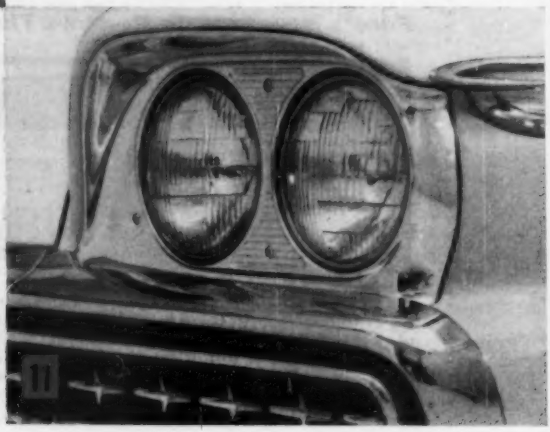
***Heads and tails: This year's versions have been on the road for***



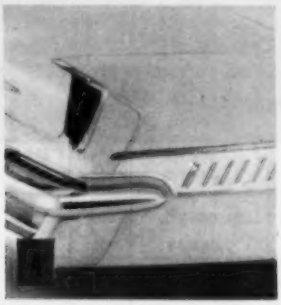



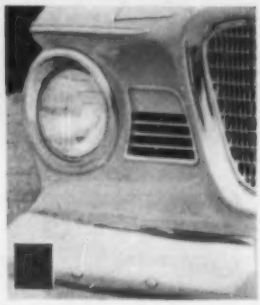



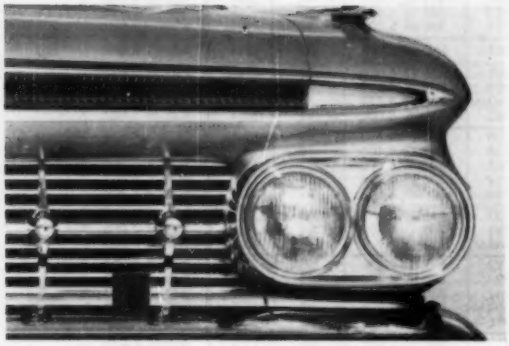



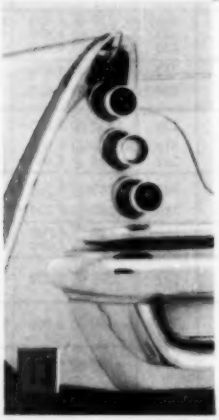
# You Looking At?

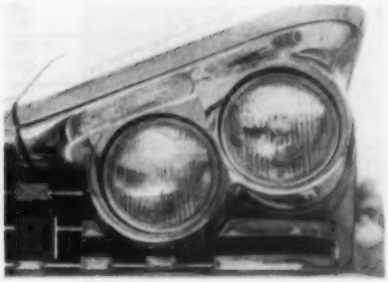
***several months now. See how many you've learned to recognize***











**ANSWERS:** 1. Lincoln; 2. Mercury; 3. Rambler; 4. Chrysler; 5. Studebaker Lark; 6. Oldsmobile; 7. Plymouth; 8. Chevrolet; 9. Edsel; 10. Dodge; 11. Ford; 12. Cadillac; 13. De Soto; 14. Buick.

# Facts and Figures on '59 Models:

## Engines

| MAKE AND MODEL | | TYPE OF ENGINE | DISPLACEMENT (cu. in.) | HORSEPOWER AT WHAT R.P.M. | HORSEPOWER PER CUBIC INCH OF DISPLACEMENT | WEIGHT PER HORSEPOWER (lb.)[a] | TORQUE AT WHAT R.P.M. (lb.-ft.) |
|---|---|---|---|---|---|---|---|
| BUICK | Le Sabre | OHV V-8 | 364 | 210 @ 4,000 | .58 | 20.1 | 340 @ 2,400 |
| | Invicta, Electra | OHV V-8 | 401 | 325 @ 4,400 | .81 | 14.0 | 445 @ 2,800 |
| CADILLAC | Series 62, Series 60, Series 75 | OHV V-8 | 390 | 325 @ 4,800 | .83 | 14.8 | 430 @ 3,100 |
| | Eldorado | OHV V-8 | 390 | 345 @ 4,800 | .89 | 14.7 | 435 @ 3,400 |
| CHEVROLET | All Series | OHV 6 | 236 | 135 @ 4,000 | .57 | 26.7 | 217 @ 2,200 |
| | | OHV V-8 | 283 | 185 @ 4,600 | .65 | 19.5 | 275 @ 2,400 |
| | | OHV V-8 | 348 | 250 @ 4,400 | .72 | 14.5 | 355 @ 2,800 |
| CHRYSLER | Windsor | OHV V-8 | 383 | 305 @ 4,600 | .80 | 12.5 | 410 @ 2,400 |
| | Saratoga | OHV V-8 | 383 | 325 @ 4,600 | .85 | 12.3 | 425 @ 2,800 |
| | New Yorker | OHV V-8 | 413 | 350 @ 4,600 | .85 | 11.8 | 470 @ 2,800 |
| | 300E | OHV V-8 | 413 | 380 @ 5,000 | .92 | 11.3 | 450 @ 3,600 |
| CORVETTE | | OHV V-8 | 283 | 230 @ 4,800 | .81 | 12.3 | 300 @ 3,000 |
| DE SOTO | Firesweep | OHV V-8 | 361 | 295 @ 4,600 | .82 | 12.4 | 290 @ 2,400 |
| | Firedome | OHV V-8 | 383 | 305 @ 4,600 | .80 | 12.6 | 410 @ 2,400 |
| | Fireflite | OHV V-8 | 383 | 325 @ 4,600 | .85 | 12.0 | 425 @ 2,800 |
| | Adventurer | OHV V-8 | 383 | 350 @ 5,000 | .91 | 11.4 | 425 @ 3,600 |
| DODGE | Coronet | L-head 6 | 230 | 135 @ 3,600 | .59 | 25.4 | 205 @ 1,200 |
| | | OHV V-8 | 326 | 255 @ 4,400 | .78 | 13.8 | 350 @ 2,400 |
| | Royal | OHV V-8 | 361 | 295 @ 4,600 | .82 | 12.0 | 390 @ 2,400 |
| | Custom Royal | OHV V-8 | 361 | 305 @ 4,600 | .85 | 12.0 | 400 @ 2,800 |
| | All Series | OHV V-8 | 383 | 320 @ 4,600 | .84 | 11.3 | 420 @ 2,800 |
| EDSEL | Ranger | OHV 6 | 223 | 145 @ 4,000 | .65 | 25.1 | 206 @ 2,200 |
| | | OHV V-8 | 292 | 200 @ 4,400 | .69 | 18.9 | 285 @ 2,200 |
| | Corsair | OHV V-8 | 332 | 225 @ 4,400 | .68 | 17.2 | 325 @ 2,200 |
| FORD | All Series | OHV 6 | 223 | 145 @ 4,000 | .65 | 23.4 | 206 @ 2,200 |
| | | OHV V-8 | 292 | 200 @ 4,400 | .69 | 17.5 | 285 @ 2,200 |
| | | OHV V-8 | 332 | 225 @ 4,400 | .68 | 15.5 | 325 @ 2,200 |
| | | OHV V-8 | 352 | 300 @ 4,600 | .85 | 11.6 | 380 @ 2,800 |
| | Thunderbird | OHV V-8 | 352 | 300 @ 4,600 | .85 | 12.7 | 395 @ 2,800 |
| IMPERIAL | All Series | OHV V-8 | 413 | 350 @ 4,600 | .85 | 13.5 | 470 @ 2,800 |
| LINCOLN & CONTINENTAL | All Series | OHV V-8 | 430 | 350 @ 4,400 | .82 | 14.2 | 490 @ 2,800 |
| MERCURY | Monterey | OHV V-8 | 312 | 210 @ 4,400 | .67 | 19.1 | 325 @ 2,200 |
| | Montclair | OHV V-8 | 383 | 322 @ 4,600 | .84 | 13.1 | 420 @ 2,800 |
| | Park Lane | OHV V-8 | 430 | 345 @ 4,400 | .80 | 12.8 | 480 @ 2,800 |
| OLDSMOBILE | Dynamic 88 | OHV V-8 | 371 | 270 @ 4,600 | .73 | 15.4 | 390 @ 2,400 |
| | Super 88, 98 | OHV V-8 | 394 | 315 @ 4,600 | .80 | 13.4 | 435 @ 2,800 |
| PLYMOUTH | Savoy, Belvedere | L-head 6 | 230 | 132 @ 3,600 | .57 | 24.8 | 205 @ 1,200 |
| | All Series | OHV V-8 | 318 | 230 @ 4,400 | .72 | 14.9 | 340 @ 2,400 |
| | | OHV V-8 | 361 | 305 @ 4,600 | .85 | 11.4 | 395 @ 3,000 |
| PONTIAC | Catalina, Star Chief | OHV V-8 | 389 | 245 @ 4,200 | .63 | 17.5 | 392 @ 2,000 |
| | Bonneville | OHV V-8 | 389 | 260 @ 4,200 | .67 | 15.7 | 400 @ 2,800 |
| RAMBLER | All Series | OHV 6 | 196 | 127 @ 4,200 | .65 | 22.2 | 180 @ 1,600 |
| | Super & Custom | OHV V-8 | 250 | 215 @ 4,900 | .86 | 15.2 | 260 @ 2,500 |
| RAMBLER AMBASSADOR | Both Series | OHV V-8 | 327 | 270 @ 4,700 | .83 | 12.7 | 360 @ 2,600 |
| RAMBLER AMERICAN | Both Series | L-head 6 | 196 | 90 @ 3,800 | .46 | 27.6 | 150 @ 1,600 |
| STUDEBAKER | Lark—Both Series, Silver Hawk | L-head 6 | 170 | 90 @ 4,000 | .53 | 28.9 | 145 @ 2,000 |
| | Lark Regal, Silver Hawk | OHV V-8 | 259 | 180 @ 4,500 | .70 | 16.4 | 260 @ 2,800 |

NOTES: [a] for the lowest-priced four-door sedan (or equivalent model if there is no sedan) in the series listed; [b] 3.36 on Series 75; [c] automatic transmission

## *Here's what's happening to U. S. cars . . . and this year they're not all bigger, more powerful and higher-priced*

| BORE AND STROKE (in.) | COMPRESSION RATIO (to 1) | FUEL REQUIRED (regular or premium) | OPTIONAL EXTRA POWER | | REAR-AXLE RATIOS (to 1) | | |
|---|---|---|---|---|---|---|---|
| | | | Horsepower | Torque | Automatic Transmission | Manual Transmission | Overdrive |
| 4.13 x 3.40 | 10.5 | R | 250 @ 4,400 | 384 @ 2,400 | 3.07 | 3.58 | – |
| 4.19 x 3.64 | 10.5 | P | — | — | 3.23 | – | – |
| 4.00 x 3.88 | 10.5 | P | 345 @ 4,800 | 435 @ 3,400 | 2.94[b] | – | – |
| 4.00 x 3.88 | 10.5 | P | — | — | 3.21 | – | – |
| 3.56 x 3.94 | 8.25 | R | — | — | 3.36 | 3.55 | 4.11 |
| 3.88 x 3.00 | 8.5 | R | 290 @ 6,200 | 290 @ 4,400 | 3.36 | 3.55 | 4.11 |
| 4.13 x 3.25 | 9.5 | P | 315 @ 5,600 | 356 @ 3,600 | 3.08 | 3.36 | – |
| 4.03 x 3.75 | 10.1 | P | — | — | 2.93 | 3.73 | – |
| 4.03 x 3.75 | 10.1 | P | — | — | 2.93 | – | – |
| 4.18 x 3.75 | 10.1 | P | — | — | 2.93 | – | – |
| 4.18 x 3.75 | 10.1 | P | — | — | 3.31 | – | – |
| 3.88 x 3.00 | 9.5 | P | 290 @ 6,200 | 290 @ 4,400 | 3.55 | 3.70 | – |
| 4.12 x 3.38 | 10.0 | P | 350 @ 5,000 | 425 @ 3,600 | 3.31 | 3.54 | – |
| 4.25 x 3.38 | 10.1 | P | 350 @ 5,000 | 425 @ 3,600 | 3.31 | – | – |
| 4.25 x 3.38 | 10.1 | P | 350 @ 5,000 | 425 @ 3,600 | 3.31 | – | – |
| 4.25 x 3.38 | 10.1 | P | — | — | 3.31 | – | – |
| 3.25 x 4.63 | 8.0 | R | — | — | 3.73 | 3.73 | – |
| 3.95 x 3.31 | 9.2 | R | — | — | 3.31 | 3.54 | – |
| 4.12 x 3.38 | 10.1 | P | — | — | 3.31 | – | – |
| 4.12 x 3.38 | 10.1 | P | — | — | 2.93 | – | – |
| 4.25 x 3.38 | 10.0 | P | 345 @ 5,000 | 420 @ 3,600 | 3.31 | – | – |
| 3.62 x 3.60 | 8.4 | R | — | — | 3.56 | 3.56 | – |
| 3.75 x 3.30 | 8.8 | R | 303 @ 4,600 | 390 @ 2,900 | 3.10 | 3.56 | – |
| 4.00 x 3.30 | 8.9 | R | 303 @ 4,600 | 390 @ 2,900 | 2.91 | 3.56 | – |
| 3.62 x 3.60 | 8.4 | R | — | — | 3.56 | 3.56 | 3.70 |
| 3.75 x 3.30 | 8.8 | R | — | — | 3.10 | 3.56 | 3.70 |
| 4.00 x 3.30 | 8.9 | P | — | — | 2.91 | – | – |
| 4.00 x 3.50 | 9.6 | P | — | — | 2.91 | 3.56 | 3.56 |
| 4.00 x 3.50 | 9.6 | P | 350 @ 4,400 | 490 @ 2,800 | 3.10 | 3.70 | 3.70 |
| 4.18 x 3.75 | 10.1 | P | — | — | 2.93 | – | – |
| 4.30 x 3.70 | 10.0 | P | — | — | 2.89 | – | – |
| 3.80 x 3.44 | 8.8 | R | 280 @ 4,400 | 400 @ 2,400 | 3.10 | 3.56 | – |
| 4.30 x 3.30 | 10.0 | P | — | — | 2.71 | – | – |
| 4.30 x 3.70 | 10.0 | P | — | — | 2.71 | – | – |
| 4.00 x 3.69 | 9.8 | P | 300 @ 4,600 | 410 @ 2,800 | 3.08 | 3.64 | – |
| 4.13 x 3.69 | 9.8 | P | — | — | 3.23[c] | 3.64[c] | – |
| 3.25 x 4.62 | 8.0 | R | — | — | 3.73 | 3.73 | 4.10 |
| 3.91 x 3.31 | 9.0 | R | 260 @ 4,400 | 345 @ 2,800 | 3.31 | 3.54 | 3.91 |
| 4.12 x 3.38 | 10.0 | P | — | — | 3.31 | 3.54 | – |
| 4.06 x 3.75 | 8.6 | R | 345 @ 4,800 | 425 @ 3,200 | 3.08 | 3.23 | – |
| 4.06 x 3.75 | 8.6 | R | 345 @ 4,800 | 425 @ 3,200 | 3.08 | 3.23 | – |
| 3.13 x 4.25 | 8.7 | R | 138 @ 4,500 | 185 @ 1,800 | 3.31 | 3.78 | 4.11 |
| 3.50 x 3.25 | 8.7 | R | — | — | 3.15 | 4.10 | 4.10 |
| 4.00 x 3.25 | 9.7 | P | — | — | 3.15 | 3.54 | 3.54 |
| 3.13 x 4.25 | 8.0 | R | — | — | 3.31 | 3.31 | 3.78 |
| 3.00 x 4.00 | 8.3 | R | — | — | 3.54 | 3.54[d] | 3.73[e] |
| 3.56 x 3.25 | 8.8 | R | 195 @ 4,500 | 265 @ 3,000 | 3.31 | 3.31[f] | 3.54[g] |

with 3.42 rear-axle ratio standard on 98; [d] 3.73 on Regal, 4.10 on Hawk; [e] 4.10 on Regal, 4.27 on Hawk; [f] 3.54 on Hawk; [g] 3.73 on Hawk.

# Facts and Figures on '59 Models:

## Bodies and Prices

| MAKE AND MODEL | | WHEELBASE (in.) | OVERALL LENGTH (in.) | WIDTH (in.) | SHIPPING WEIGHT (lb.)[a] | WEIGHT PER SQ. IN. OF BRAKELINING AREA (lb.)[a] | OVERALL STEERING RATIO: Manual | OVERALL STEERING RATIO: Power | TURNING-CIRCLE DIAMETER, CURB TO CURB (ft.) | TIRE SIZE |
|---|---|---|---|---|---|---|---|---|---|---|
| BUICK | Le Sabre, Invicta, Electra 4700 | 123.0 | 217.4 | 81.0 | 4,229 | 26.4 | 28.8 | 19.7 | 44.0 | 7.60 x 15 |
| | | 126.3 | 220.6 | 80.7 | 4,557 | 28.5 | — | 19.7 | 45.7 | 8.00 x 15 |
| CADILLAC | Series 62 | 130.0 | 225.0 | 80.2 | 4,835 | 23.0 | — | 18.9 | 47.0 | 8.00 x 15 |
| | Series 60 | 130.0 | 225.0 | 81.1 | 4,890 | 23.2 | — | 18.9 | 47.0 | 8.00 x 15 |
| | Eldorado | 130.0 | 225.0 | 80.2 | 5,074 | 24.2 | — | 18.9 | 47.0 | 8.20 x 15 |
| | Series 75 | 149.8 | 244.8 | 80.2 | 5,490 | 23.4 | — | 18.9 | 49.2 | 8.20 x 15 |
| CHEVROLET | Biscayne, Bel Air, Impala | 119.0 | 210.9 | 79.9 | 3,619 | 18.1 | 28.0 | 24.0 | 40.2 | 7.50 x 14 |
| CHRYSLER | Windsor | 122.0 | 216.6 | 79.3 | 3,800 | 16.5 | 30.0 | 19.1 | 43.7 | 8.00 x 14 |
| | Saratoga, New Yorker | 126.0 | 220.6 | 79.3 | 4,010 | 16.0 | 30.0 | 19.4 | 47.0 | 8.50 x 14 |
| | 300E | 126.0 | 220.9 | 79.5 | 4,290 | 17.1 | 30.0 | 19.4 | 47.1 | 9.00 x 14 |
| CORVETTE | | 102.0 | 177.2 | 72.8 | 2,842 | 18.1 | 21.0 | — | 37.0 | 6.70 x 15 |
| DE SOTO | Firesweep | 122.0 | 215.5 | 78.7 | 3,670 | 16.0 | 30.0 | 19.1 | 43.7 | 8.00 x 14 |
| | Firedome, Firelite | 126.0 | 219.5 | 78.7 | 3,840 | 15.3 | 30.6 | 19.4 | 47.0 | 8.50 x 14 |
| | Adventurer | 126.0 | 221.1 | 78.7 | 3,980 | 15.8 | 30.6 | 19.4 | 47.0 | 8.50 x 14 |
| DODGE | Coronet 8, Royal, Custom Royal | 122.0 | 217.4 | 80.0 | 3,615 | 17.5 | 30.0 | 19.1 | 43.7 | 7.50 x 14 |
| EDSEL | Ranger, Corsair | 120.0 | 210.9 | 79.8 | 3,880 | 22.4 | 31.8 | 27.0 | 41.9 | 8.00 x 14 |
| FORD | Custom 300, Fairlane, Fairlane 500 | 118.0 | 208.0 | 76.7 | 3,485 | 19.4 | 27.0 | 25.2 | 40.6 | 7.50 x 14 |
| | Thunderbird | 113.0 | 205.3 | 77.0 | 3,813 | 16.9 | 25.0 | 25.0 | 40.3 | 8.00 x 14 |
| IMPERIAL | Custom, Crown, Le Baron | 129.0 | 226.3 | 81.0 | 4,735 | 18.8 | — | 19.4 | 48.2 | 9.50 x 14 |
| LINCOLN & CONTINENTAL | Lincoln, Premiere, Continental | 131.0 | 227.1 | 80.1 | 4,986 | 19.0 | — | 19.5 | 45.0 | 9.50 x 14 |
| MERCURY | Monterey, Montclair | 126.0 | 217.8 | 80.7 | 4,001 | 19.5 | 29.1 | 20.5 | 44.0 | 8.00 x 14 |
| | Park Lane | 128.0 | 222.8 | 80.7 | 4,430 | 21.6 | — | 20.5 | 43.9 | 8.50 x 14 |
| OLDSMOBILE | 88, Super 88 | 123.0 | 218.4 | 80.8 | 4,162 | 26.5 | 29.4 | 21.8 | 45.7 | 8.50 x 14 |
| | 98 | 126.3 | 223.0 | 80.8 | 4,433 | 28.2 | — | 21.8 | 43.9 | 9.00 x 14 |
| PLYMOUTH | Savoy, Belvedere, Fury | 118.0 | 208.2 | 78.0 | 3,425 | 18.6 | 26.8 | 19.1 | 42.2 | 7.50 x 14 |
| PONTIAC | Catalina | 122.0 | 213.7 | 80.7 | 3,940 | 23.2 | 29.0 | 22.0 | 42.7 | 8.00 x 14 |
| | Star Chief | 124.0 | 220.7 | 80.7 | 3,990 | 23.5 | 29.0 | 22.0 | 43.8 | 8.00 x 14 |
| | Bonneville | 124.0 | 220.7 | 80.7 | 4,070 | 23.9 | 29.0 | 22.0 | 43.8 | 8.00 x 14 |
| RAMBLER | Deluxe, Super, Custom | 108.0 | 191.2 | 72.2 | 3,287 | 19.6 | 28.8 | 18.4 | 37.6 | 7.50 x 14 |
| RAMBLER AMBASSADOR | Super, Custom | 117.0 | 200.2 | 72.2 | 3,428 | 20.4 | 25.6 | 25.4 | 39.8 | 8.00 x 14 |
| RAMBLER AMERICAN | Deluxe, Super | 100.0 | 178.3 | 73.0 | 2,476 | 17.8 | 22.0 | — | 36.0 | 5.90 x 15 |
| STUDEBAKER | Lark Deluxe 6 | 108.5 | 175.0 | 69.0 | 2,597 | n.a. | 19.5 | — | 37.5 | 5.90 x 15 |
| | Lark Regal 8 | 108.5 | 175.0 | 69.0 | 2,957 | n.a. | 24.5 | 18.2 | 37.5 | 6.40 x 15 |
| | Silver Hawk 6/8 | 120.5 | 204.0 | 71.3 | 3,140 | n.a. | 24.5 | 18.2 | 41.0 | 6.70 x 15 |

**NOTES:** n.a.: this information not available at press time; [a]for the lowest-priced four-door sedan with eight-cylinder engine (or nearest equivalent model) in the series listed; [b]all prices include federal excise tax and preparation and handling charges,

## They range all the way from the 175-inch, under-$2,000 Lark to a 2¾-ton, 20-foot-plus Caddy that goes for $9,500

| LEG ROOM (in.) | | HEAD ROOM (in.) | | HIP ROOM (in.) | | PRICE[b] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Front | Rear | Front | Rear | Front | Rear | Base (8 cyl. engine) | Automatic Transmission | Power Steering | Power Brakes | Air Conditioning | Radio | Heater | Air Springs |
| 44.0 | 42.8 | 34.7 | 33.9 | 65.4 | 65.4 | $2,804<br>3,357 | $220<br>std | $108<br>108 | $ 43<br>43 | $430<br>430 | $102<br>102 | $102<br>102 | $145<br>145 |
| 43.7 | 46.2 | 34.3 | 33.4 | 65.2 | 65.0 | 3,856 | std | std | std | 430 | 102 | 102 | 145 |
| 45.6 | 45.3 | 34.8 | 33.2 | 64.6 | 64.4 | 5,080 | std | std | std | 474 | 165 | 129 | 215 |
| 45.5 | 43.6 | 35.0 | 33.0 | 64.6 | 64.4 | 6,233 | std | std | std | std | 165 | 129 | 215 |
| 45.6 | 38.6 | 33.2 | 33.8 | 66.3 | 57.0 | 7,401 | std | std | std | 474 | std | std | std |
| 43.9 | 37.4 | 36.2 | 34.8 | 65.4 | 60.1 | 9,533 | std | std | std | 624 | 165 | 179 | 215 |
| 45.0 | 42.8 | 36.1 | 34.3 | 66.1 | 65.5 | 2,419<br>2,558<br>2,710 | 199 | 75 | 43 | 468[c] | 62 | 52 | 135 |
| 45.5 | 43.0 | 35.7 | 34.3 | 63.0 | 62.7 | 3,204 | | | | | | | |
| 45.5 | 43.0 | 35.7 | 34.3 | 63.0 | 62.7 | 3,966 | std | 108 | 44 | 510[c] | 100 | 102 | 145 |
| 45.5 | 38.0 | 34.4 | 33.7 | 63.0 | 56.0 | 4,424<br>5,319 | | | | | | | |
| 45.1 | — | 35.3 | — | 59.6 | — | 3,875 | 199 | — | — | — | 150 | 102 | — |
| 45.5 | 43.0 | 35.7 | 34.5 | 63.0 | 62.7 | 2,904 | 189 | 106 | 43 | 501[c] | 94 | 98 | 140 |
| 45.5 | 43.0 | 35.7 | 34.5 | 63.0 | 62.7 | 3,234 | 227 | 106 | 43 | 501[c] | 94 | 98 | 140 |
| 45.5 | 38.0 | 34.4 | 33.7 | 63.0 | 56.0 | 3,763 | std | 106 | 43 | 501[c] | 94 | 98 | 140 |
| | | | | | | 4,427 | std | std | std | 501[c] | 94 | 98 | 140 |
| 45.5 | 42.5 | 35.7 | 34.5 | 63.0 | 62.7 | 2,707<br>2,934<br>3,145 | 189<br>std<br>std | 92<br>92<br>92 | 43<br>43<br>43 | 379<br>379<br>379 | 87<br>87<br>87 | 94<br>94<br>94 | 128<br>128<br>128 |
| 42.8 | 40.4 | 33.8 | 33.5 | 60.4 | 60.8 | 2,684<br>2,812 | 190 | 82 | 43 | 431[c] | 65 | 74 | — |
| 42.7 | 40.3 | 33.5 | 33.3 | 60.4 | 60.8 | 2,391<br>2,529<br>2,648 | 190 | 75 | 43 | 404[c] | 59 | 48 | — |
| 43.4 | 38.1 | 34.5 | 33.3 | 59.6 | 48.7 | 3,696 | 242 | 75 | 43 | 466[c] | 105 | 83 | — |
| 45.5 | 46.5 | 36.2 | 34.2 | 61.0 | 60.2 | 5,016<br>5,647<br>6,103 | std | std | std | 590[c] | 153 | 136 | 156 |
| 44.1 | 46.1[d] | 34.9 | 33.7 | 61.0 | 65.5 | 5,090<br>5,594<br>6,845 | std<br>std<br>std | std<br>std<br>std | std<br>std<br>std | 475<br>475<br>475 | 164<br>164<br>std | 129<br>129<br>std | —<br>—<br>— |
| 44.3 | 43.6 | 33.2 | 32.9 | 62.5 | 62.8 | 2,832<br>3,308 | 226<br>std | 108<br>108 | 44<br>44 | 489[c]<br>489[c] | 87<br>87 | 81<br>91 | —<br>— |
| 44.3 | 41.5 | 33.2 | 32.9 | 62.5 | 62.8 | 4,031 | std | std | std | 489[c] | 87 | 91 | — |
| 44.8 | 42.5 | 34.9 | 34.2 | 66.1 | 65.5 | 2,902<br>3,178 | 231 | 108 | 43 | 430 | 102 | 102 | n.a. |
| 44.5 | 45.4 | 34.9 | 34.2 | 66.1 | 65.5 | 3,890 | std | std | std | 430 | 102 | 102 | n.a. |
| 45.5 | 41.5 | 35.7 | 34.2 | 63.0 | 62.7 | 2,394<br>2,551<br>2,691 | 189 | 77 | 43 | 446[c] | 73 | 74 | 106 |
| 44.8<br>44.6<br>44.6 | 42.5<br>42.2<br>41.1 | 34.8<br>34.8<br>32.8 | 33.9<br>33.9<br>34.2 | 65.4<br>65.4<br>65.4 | 65.4<br>65.4<br>66.2 | 2,704<br>3,005<br>3,333 | 231 | 108 | 43 | 430 | 102 | 102 | 188 |
| 43.0 | 40.0 | 36.0 | 35.0 | 59.8 | 60.1 | 2,098[e]<br>2,398<br>2,513 | 200<br>220<br>220 | 70<br>80<br>80 | 38 | 369[c] | 76 | 76 | 99 |
| 43.0 | 40.0 | 36.0 | 35.0 | 59.8 | 60.1 | 2,587<br>2,732 | 230 | 90 | 40 | 398[c] | 92 | 83 | 99 |
| 44.0 | 37.5 | 35.3 | 34.0 | 58.0 | 45.25 | 1,835[e]<br>1,920[e] | 179 | — | — | — | 58 | 72 | — |
| 44.0<br>44.0<br>44.0 | 41.0<br>41.0<br>36.0 | 36.0<br>36.0<br>35.5 | 35.0<br>35.0<br>33.8 | 59.5<br>59.5<br>59.5 | 59.0<br>59.0<br>58.0 | 1,995[e]<br>2,310<br>2,495 | 200 | 69 | 38 | 325 | 61 | 71 | — |

but no other taxes or shipping charges. Base price applies to the least-expensive four-door sedan (or nearest equivalent), with eight-cylinder engine but no other optional equipment, in each series; [c] includes a heater; [d] 42.4" on Continental; [e] six-cylinder engine

## Detroit faces up to

# The Baffling Problem of Brake Fade

**MODERN BRAKE TESTING** combines elements of a punishing road race with the precision of a controlled laboratory experiment. Buick uses two cars for base-line data and two for each different experiment. Tests are standardized so that they can be repeated from run to run.

***Heavier cars, bigger engines, 14-inch wheels, and changing driving habits are piling up headaches for brake designers***

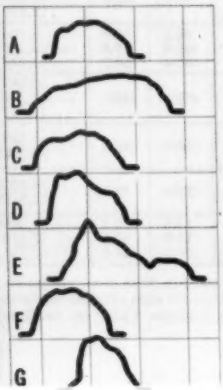
**By Hubert Luckett**

*". . . started hardening ⅓ way down mountain. Hard initial and pronounced fade ½ way, odor, lead left. Left front smoking, greasy initial, became unsafe (1,200 psi) near bottom. Over-recovered, brakes very sensitive. 'Death rattle' on last stop. Test discontinued and car returned to plant."*

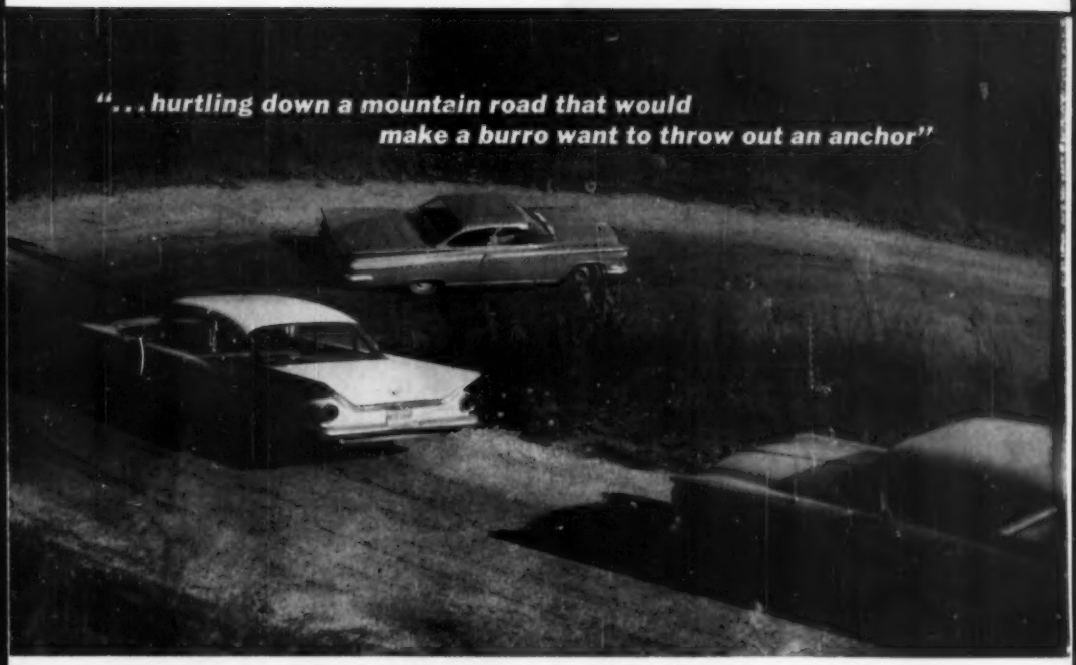
THIS epitaph on an experimental brake lining was copied from one of the hundreds of confidential reports made on the West Virginia Mountain Tests that have been conducted jointly by Buick and Inland Manufacturing Company since 1951.

I went along as an observer on one of these three-day, 1,000-mile runs through the mountains of West Virginia as a part of this job of reporting to you what Detroit is doing about brakes. I also talked to more than a dozen brake and brake-lining engineers.

In '59 you'll probably hear more bragging about brakes than about engine horsepower. For good reason: Some of the makes that had fallen behind on brakes have not only caught up, but in




**FOOTPRINT** of each driver on the pressure-recording graph is unique. Traces at left, copied from actual recordings, show characteristic brake-application curves of seven different men. Test procedure calls for switching drivers periodically to wash out effect individual driving habits have on test results.




some cases pulled ahead of competition.

Here's a quick look at some of the factors that have pushed the brake problem into the news:

- Since '50-'51, brake engineers have had to run fast just to keep brake performance up to the previous year's levels.
- Greater braking capacity is made necessary by changing design: heavier cars, quicker accelerations resulting from today's bigger engines, less engine braking as a result of automatic transmissions.
- The stylists—with their 14" wheels, sheet-metal shrouds, and solid wheel covers—have made the brake engineer's job even tougher.
- Driving habits have changed, almost without the industry noticing it. The new high-speed freeways require heavier-duty brakes than car makers have been designing.

Just about any car built in this country, since Chrysler introduced four-wheel hydraulic brakes in 1927, has been able to stop quickly enough to unseat its passengers—when the brakes are in good condition. Bare stopping ability for an occasional panic stop has not been the problem.

But here are two real problems:

One, suppose you're late to work, and you have to make 15 or 20 miles through fast-moving freeway traffic—the kind that requires a dozen or so heavy brake applications to the mile to avoid hitting those jerks who keep darting in front of you.

Two, suppose you descend a long, steep mountain road, holding back with the brakes all the way, with hard braking before each turn and twist of the road.

These two situations are brake killers.

In such circumstances brake fade becomes a vital concern to a lot of passenger-car drivers, instead of just an occupational hazard for racing drivers.

Experience has shown that you can't find reliable answers in the laboratory or on the test tracks. So brake engineers have stowed their slide rules and taken to the road. And, indirectly, this was why I found myself with both feet braced against the firewall, in a test car hurtling down a West Virginia mountain road that would make a burro want to throw out an anchor.

The laconic case history at the beginning of this article is a good example of what can happen. Here was an experimental brake that seemed good in theory. Laboratory tests indicated great promise, and a heavy testing schedule on the proving grounds seemed to bear this out. But the mountain tests showed that for the two or three percent of drivers who

## *In a squalling halt from 75 m.p.h., brakes must develop the*

would give their brakes this kind of hard abuse, the proposed brakes were unsatisfactory.

***Heat is the main problem.*** Brakes are essentially heat engines working in reverse. To bring a car doing 75 m.p.h. to a squalling halt, they must develop the equivalent of 500 to 800 horsepower, depending on the weight of the car and the time it takes to stop it. A modern brake system can readily supply this fantastic stopping power on a once-in-a-while basis. But, if brakes were called on to absorb energy continuously the way an engine must produce energy, they could only lay claim to about 10 horsepower for full-time stopping power.

When the brakes are applied, the energy of the moving car is converted into heat by the friction of the linings against the drums. This heat must be absorbed and then dissipated by the brakes. The amount of energy a brake can convert in a single application is largely limited by the amount of heat the metal parts of the brake can absorb; their capacity for continuous duty is limited by the rate at which the metal parts can get rid of the heat.

It is like dumping water into a leaky bucket. The larger the bucket, the more water you can dump in at one time—and the bigger the leak, the more water you can pour in continuously once the bucket has been filled.

***The "black art."*** Brake-lining materials largely determine how hot the brakes can get and still be effective. The ability to operate at higher maximum temperatures gives a double-barreled assault on the problem. The higher the maximum acceptable temperature, the greater the heat-absorbing capacity of a given drum; the greater the difference in temperature between the drum and the surrounding air, the faster the heat will be dissipated.

Research on lining materials has advanced the art enormously in the past few years. But brake engineers refer to it as the "black art" because it is the try-it-and-see type of research. The recipes they come up with are closely guarded trade secrets.

***Brake fade is their bogy.*** This is the temporary but alarming loss of brake effectiveness due to heat. No one is quite sure what happens, but at some critical temperature the brakes behave as though the friction surfaces had been lubricated. At this point, no amount of increase in pedal pressure gives a significant increase in stopping ability.

Some brake linings are enormously more fade resistant than others. One of the tests on the mountain run I rode on was on an experimental lining. Looking over the performance curves at the end of the run, it appeared that the new lining provided a significant improvement over current-production standard linings.

If it shows up well on Buick's metropolitan test schedule in Los Angeles, chances are that it will become standard production for Buicks before the year is over.

Virtually all production automobile brake linings are of the organic type. The top grades are made of asbestos fibers with phenolic-resin binders and certain added stabilizers and friction modifiers.

### *Jargon of the Brake Engineers*

**Brakes hardened.** Decrease in effectiveness as the brakes are used.

**Burnish.** Process of breaking in new linings so that lining contact and lining surface become stabilized.

**Chatter.** Low-frequency vibration in a brake.

**Crunchiness.** Roughness sensed through the pedal as though the linings are crushing. This occurs with light braking and is accompanied by a noise like crushing eggshells.

**Delayed fade.** Increase in fade during a normal recovery period.

**Fade.** Temporary reduction of brake effectiveness resulting from high temperature.

**Effectiveness.** Measure of the applied brake effort to achieve a set braking effect.

**Grabby action.** High effectiveness making it difficult to slow down gently.

**Greasy feel.** Severe case of hard initial which gives the sensation of no brakes at all.

**Hard initial.** Circumstance in which little stopping action is obtained with increasing pedal force, until a point is reached where stopping action suddenly increases with little added pedal force.

**Lead.** Pull to the right or left during braking.

**equivalent of 500 to 800 hp.**

(A favorite elixir is the juice pressed from the hulls of cashew nuts.) Variations of this basic recipe produce linings of widely varying characteristics.

The industry is divided on riveted vs. bonded linings. Chrysler uses bonded. Ford and GM engineers privately concede that they would like to take advantage of the longer life of bonded, if they could lick the noise problem.

***Metallic linings?*** These are something new. They are usually blocks of fine metal particles fused together under intense heat and pressure. Their most promising (and at the same time, exasperating) quality is an inverse-fade characteristic—the hotter they get, the better they hold. This might seem like the answer to the brake engineers' prayer—but there is a catch: They stubbornly refuse to perform when cold. Engineers are optimistic about future possibilities of metallic linings, but they caution that much development work is still needed.

***Getting rid of the heat.*** Brake drums must offer a compatible surface for the lining to work against and supply the largest portion of surface to absorb the heat initially and then dispose of it. Everyone now uses cast iron for the rubbing surface.

Probably the biggest brake-development news of the past couple of years is Buick's introduction of the finned aluminum drums in front last year, and the addition of finned iron drums in the rear this year. Even engineers for their competition are privately handing them kudos—although they hasten to add that Buick was in more trouble with their brakes in previous years and hence needed to spend the extra money that these innovations cost.

**VENTILATED WHEELS** were one of the experiments. In theory they cool drums, but results point up elusive nature of brake research: On one test car they helped, but not on the other.

There are unconfirmed reports that Buick will soon announce service packages that will enable owners of older models to get the benefits of the new brake developments.

Aluminum drums have the advantage of affording a larger heat reservoir for a given weight and of conducting the heat more rapidly to the outside of the drum where it can be dissipated. Iron liners are used for the friction surface. The fins increase the radiating surface for faster cooling.

***How big is a brake?*** Describing the capacity of a brake in relation to the job it has to do has been a knotty problem. Vehicle weight per square inch of brake-lining area is the index commonly used. But most brake engineers point out that this doesn't always give answers that correspond to experimental evidence. Ex-

[*Continued on page 234*]

**Lining glaze.** Condition in which the lining has a polished, hard, continuous surface, apparently caused by resin coating it.

**Morning sickness.** Tendency of brakes to grab after remaining idle overnight. Usually caused by moisture from the air combining with dust on the linings or reacting with the drum to form iron oxide.

**Over-recovered.** Higher effectiveness after a recovery period than before a fade test.

**Pinch-out squeak.** Squeak at or near the end of a brake stop.

**Punky.** Condition of a lining that has lost strength and hardness, usually due to sustained overheating.

**Roughness.** Pulsation or vibration at the pedal, sometimes accompanied by a cyclic low-frequency noise from the brakes when applied.

**Spongy pedal.** Soft, unstable pedal feel, requiring excessive pedal travel for increasing pedal force.

**Squawk.** Low-frequency sound of less than 300 c.p.s. made by the brakes.

**Squeak.** High-frequency sound of more than 900 c.p.s. made by the brakes.

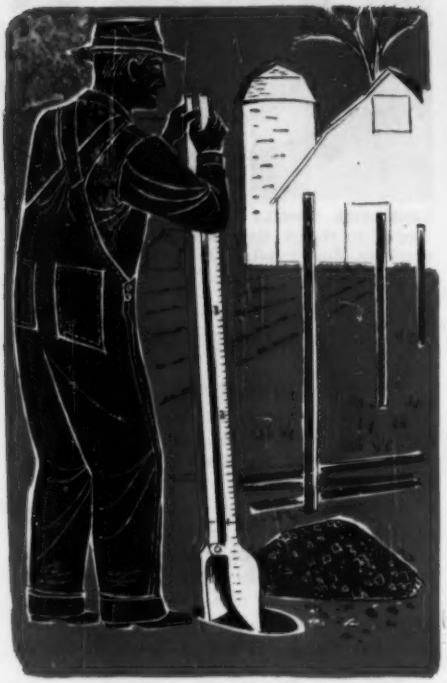
**Squeal.** Medium-frequency sound between 300 and 900 c.p.s., made by brakes.

**Wrap-in.** Sudden increase in stopping action without an increase in pedal force.

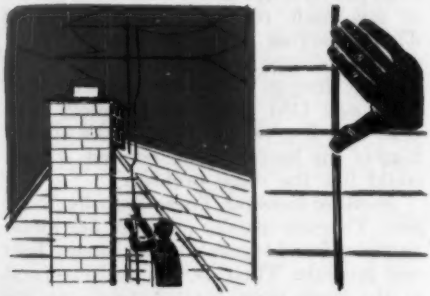


What's in the Air

# "I'd like to see them make..."

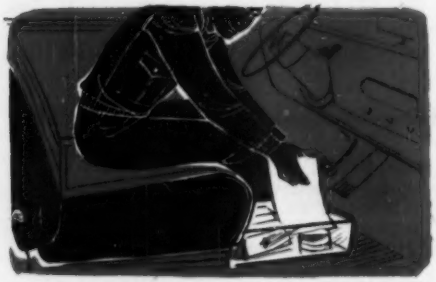


**POSTHOLE DIGGERS WITH DEPTH MARKINGS** in feet and inches on one handle. Then there'd be no need for repeatedly trying the pole in the hole.—*Stephen Walton, White Plains, N. Y.*

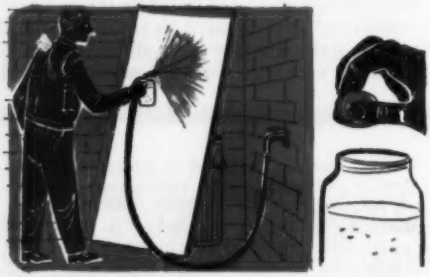


**STICK-ON LEAD-IN WIRE.** Pressure-sensitive adhesive would anchor it fast from the antenna down the side of house, along the joist, floor or baseboard.—*H. P. Fischer, Rochester, Pa.*

**SIGNAL STRIPS** on frozen-food packages. Of heat-sensitive paper, they'd change color to warn buyers if kept warm long enough to impair the food.—*Mrs. G. Rosenfeld, Bronx, NYC.*



**MORE STORAGE INSIDE CARS** to hold the overflow from the glove compartment. Why not put a washable plastic drawer beneath the front seat?—*C. L. Berger, Plainview, N. Y.*

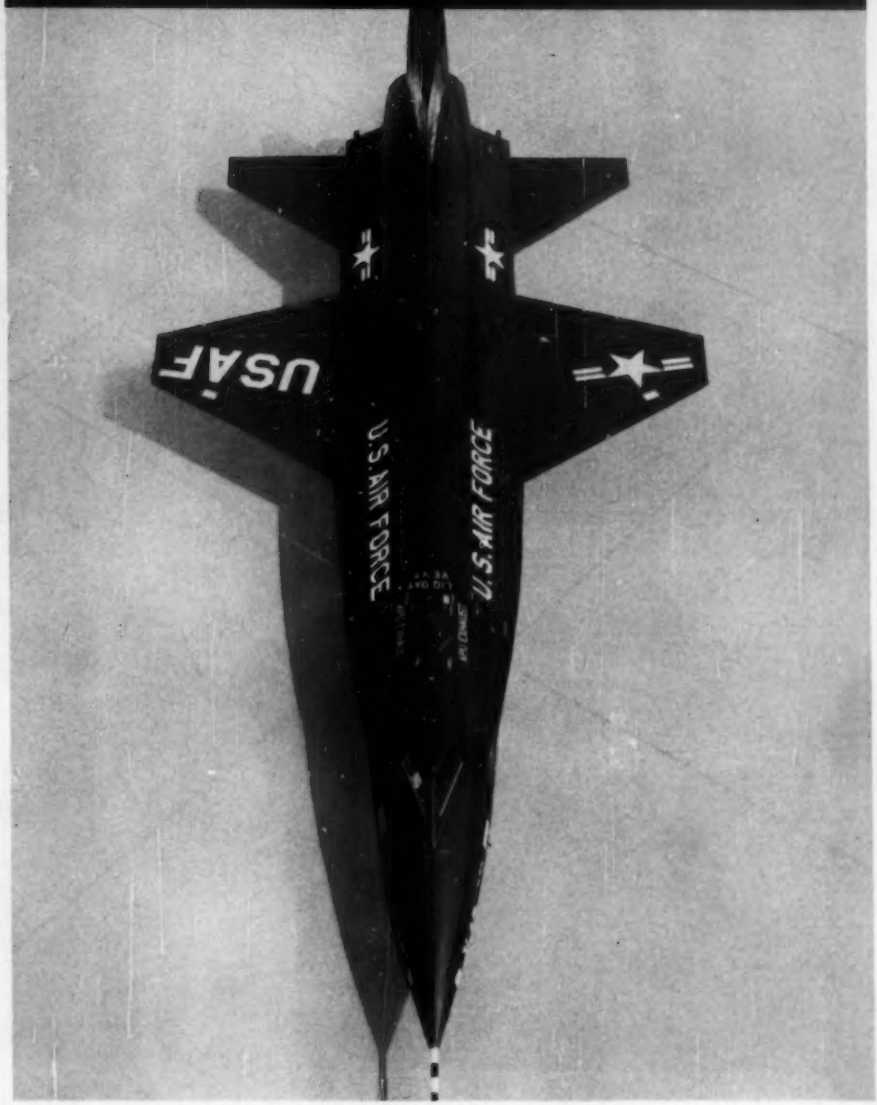


**WATER-PAINT CAPSULES** for use with a garden hose. You'd simply drop the capsule in a special container, turn on the water and hose on the paint.—*J. M. Blasko, Savanna, Ill.*

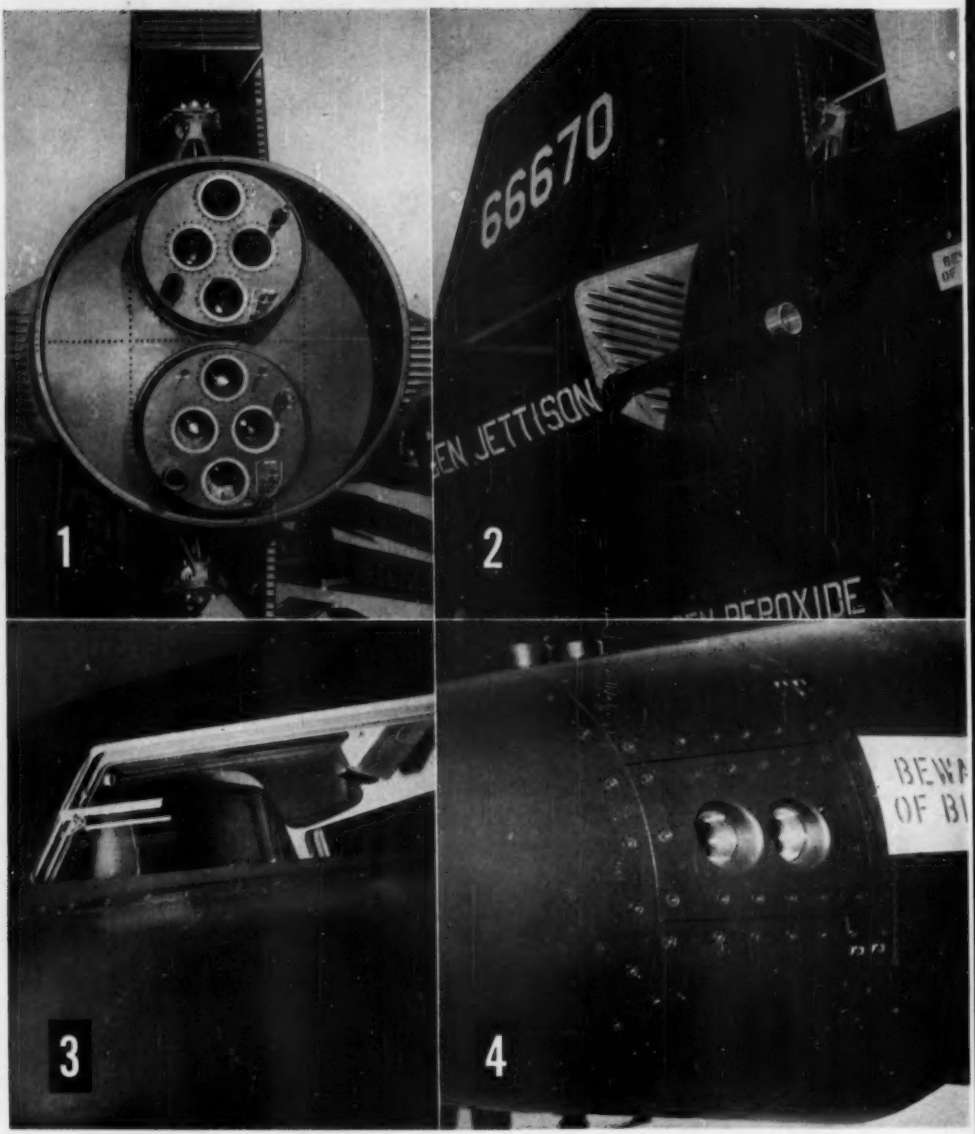
Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by POPULAR SCIENCE readers. What's *yours?* We will pay $5 for each one published. Please use Government postcards only. Write name and address clearly. Contributions cannot be acknowledged or returned.

# What's in the Air

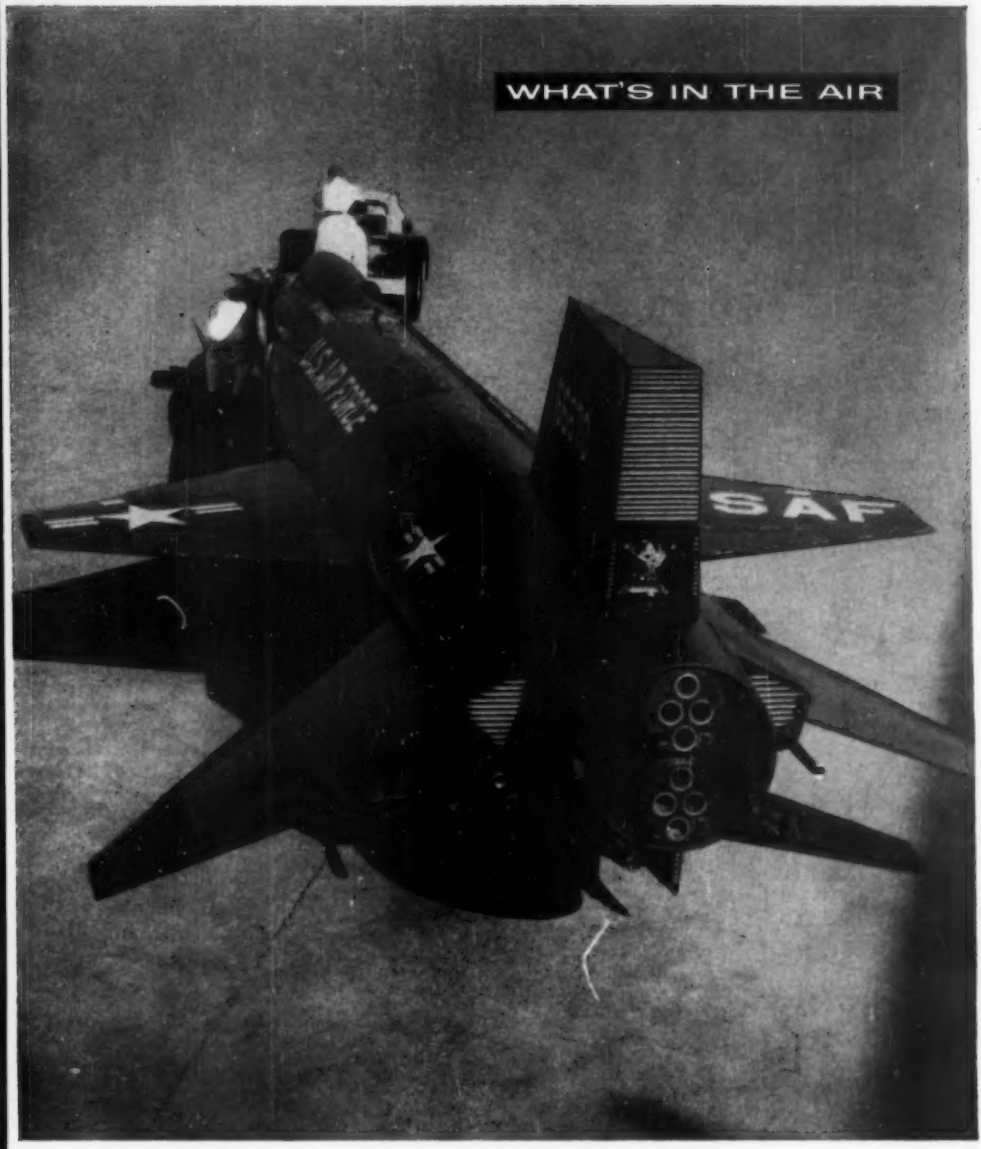
PLANES · ROCKETS · MISSILES




**Manned space rocket.** This red-hot blackbird will zing in five times as fast as sound. It's North American's X-15 rocket plane, the first designed to fly a man in space. Launched from a B-52 "mother," it makes its first flight next month—400 miles—from Bonneville Salt Flats in Utah to a California dry lake. It will take 20 minutes, reach 100 miles up, hit 3,600 m.p.h. Liquid nitrogen at 300 below zero helps cool it inside to keep friction from frying the pilot. Turn page for more on X-15.



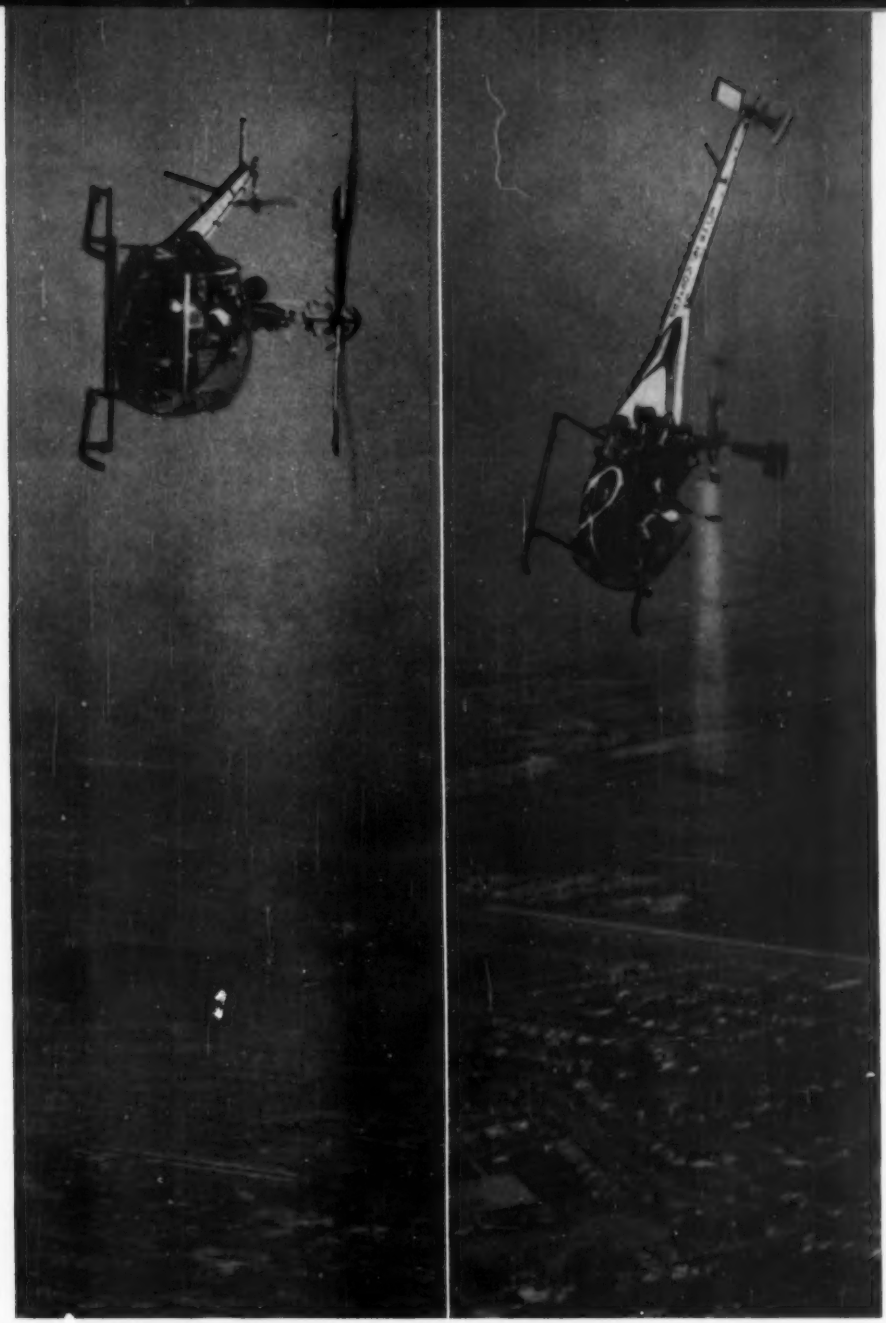

**Manned space rocket** (cont.) Some radical-design features of the X-15: (1) Twin rocket engines, soon to be supplanted by Reaction Motors' flame-throwing XLR-99 with 50,000 pounds thrust. (2) Jettison pipe for liquid oxygen if the bird gets into trouble. (3) Padded vise to keep pilot's head in place during sudden deceleration and weightless flight. (4) Blowholes at top, bottom and sides of nose for squirting jets of hydrogen peroxide steam and giving the pilot control—up, down, to either side—in outer space where aerodynamic controls are useless in



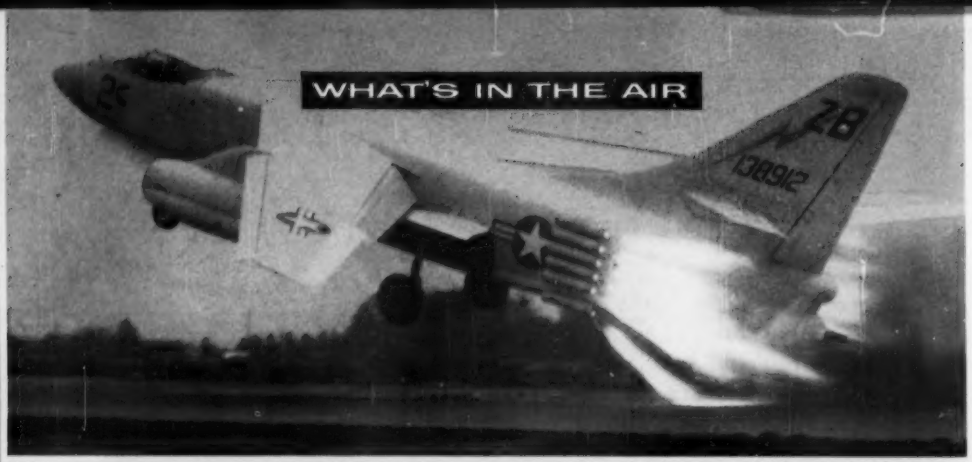

the absence of air. The droopy-looking horizontal tail in the rear view above may well be the most sophisticated tail ever built. It moves up or down to act as an elevator, pivots as an aileron while in atmosphere. The stubby wings are fixed, fitted only with flaps for slowing landing speed. The monster blunt wedge of the vertical tail is specially designed for sensitive control at high speeds and altitudes. Air brakes worked by linkage shown in the boxlike cubbyholes at top and bottom of the fuselage jut into the airstream at supersonic speeds without carrying away.

**Assembly-line jets.** To meet orders from 15 airlines for the 600-mile-an-hour 707 jet airliner, Boeing's Renton, Wash., plant is crowded to capacity. Eleven planes in various stages of completion are shown here. Transcontinental version (foreground) flies coast-to-coast in 4½ hours.

**Split-tail speedster.** Supersonic flight of Britain's new Blackburn NA 39 Navy "strike" fighter plane comes from two de Havilland Gyron Junior jet engines, with a thrust of 7,000 pounds each, and "Coke-bottle" shape (bulge behind wing roots). To slow it down for aircraft-carrier landings, the elongated tail opens up like a flower and becomes an air brake.



**Helicopter capers.** It takes a lot of power—and piloting—to put a whirlybird through these maneuvers: flying on its side (left) and diving straight down (right). The new Hiller 12E three-place utility copter does it with a 305-hp. Lycoming engine. A light rotor plane designed for civilian use, the craft was demonstrated recently at Palo Alto, Cal.



**Up she goes.** With the aid of a dozen JATO bottles, this A3D Skywarrior takes off with a shorter run than a football field affords. It can be launched from present-day carriers—like the Ranger (lower photo) for which it furnishes the big punch—with jet assist alone, no help from catapults.

**Window shopping for jet parts.** The Fleet Ready Issue Store at the Naval Air Base in Sanford, Fla., cuts red tape and speeds the issue of vital aircraft parts. All a mechanic needs to do now is find a wanted part in one of the showcases, note its stock number and put in his order.

# Amazing Fluorocarbons Promise Stainproof Clothing

***Other boons: 100,000-mile tires, greaseless bearings, rustproof steel, artificial arteries***

**By Harland Manchester**

ON A laboratory bench in St. Paul, Minnesota, stands a vial of liquid divided into red, green and transparent layers. Shake it and it becomes uniformly pinkish, put it down and it rapidly separates into the original pattern.

"The top red layer is dyed motor oil," explained Dr. Hugh Bryce, research chemist of the Minnesota Mining and Manufacturing Company. "The next layer is colored water, and the clear layer at the bottom is a new liquid fluorocarbon which has the rare and useful ability of repelling both water and oil.

"Now look at the sleeves of this jacket. Do they feel the same?" They did, so far as I could tell.

Dr. Bryce spattered both gray flannel sleeves with water, motor oil, olive oil, soya sauce and melted butter. He blotted the left sleeve, leaving it immaculate; the right sleeve was a wet mess ready for the cleaner.

"The left sleeve," he explained, "has been treated with fluorocarbon resin. It

## *Fluorocarbons stem from "wildest" of elements: fluorine*

forms a protective layer around each fiber of the cloth that resists wetting and soiling. Of course you can rub the grease in between the fibers, but they don't absorb it. The stain doesn't spread, and you can spot-clean it without leaving a ring. This resin is fairly new, but already many treated garments have gone to the cleaners four or five times without destroying its effectiveness."

***Laboratory magic.*** He then put two pieces of green cotton-rayon upholstery fabric in a carton and shook them in some special dirt containing iron rust, lampblack, olive oil, clay and rotted plant debris. Both came out filthy, but when he batted them against the bench, most of the dirt fell off the treated piece, while the untreated sample remained black.

"Scotchgard," as "3M" calls the new resin, has so impressed the furniture trade that about 200 manufacturers are using the process for stain-resistant chairs and sofas. One textile processor, the Perma Dry Company of New York, has stainproofed a quarter of a million yards of upholstery fabric in the last eight months, in lots running from a few yards for a single chair to 4,000 yards of gold silk damask and gold brocade for the seats and hangings of the newly decorated St. James Theater in New York. Other consignments now cover the furniture in the public rooms of the two new Grace Line ships, the Santa Rosa and the Santa Paula, and in a number of hotels. Users predict that it will make brighter furniture colors practical.

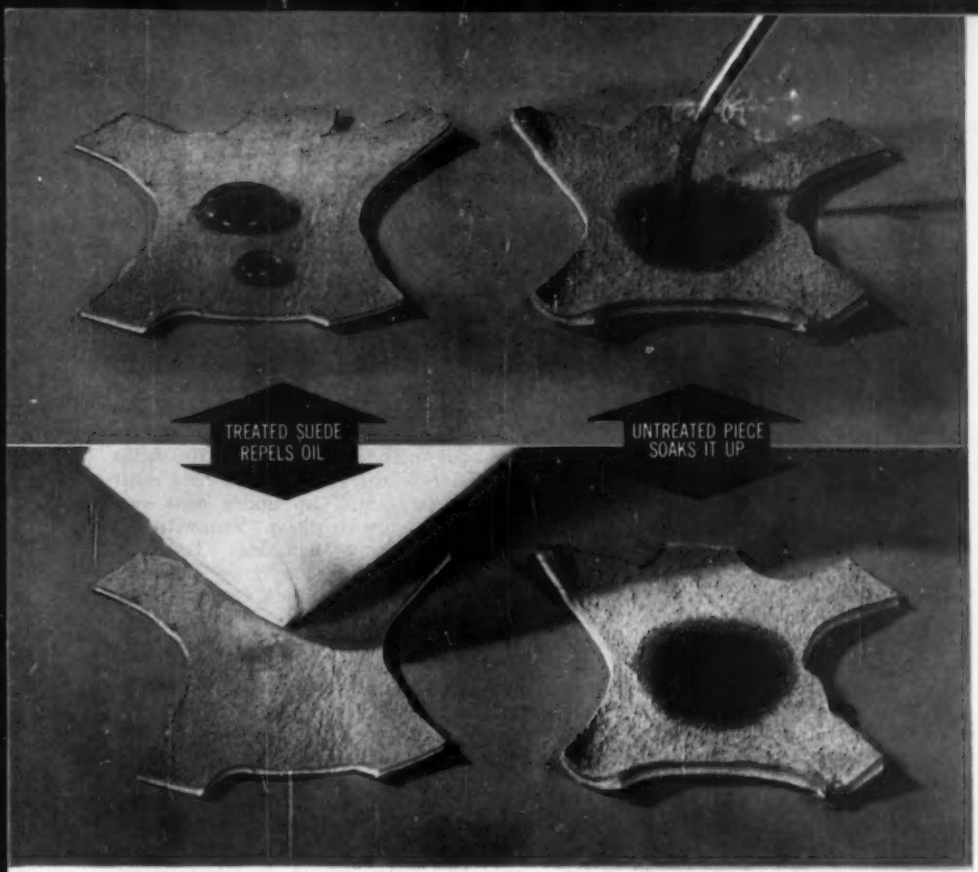
The process has been tried on some clothing textiles. Eleven airlines, where food spilling is a special problem, have equipped their hostesses with Scotchgard-treated uniforms. On sale in many stores are men's gabardine slacks, and (more recently) suits and neckties that have been treated. Still in the laboratory is a method for resin-treating washable cotton and synthetic fabrics, so that men's shirts, women's dresses and children's clothes will resist staining. These may reach the market in another year.

The new resin also protects leather. It has been applied to white shoes worn by nurses and waitresses, and 3M researchers believe that eventually all shoes can be treated so that they will not only resist soaking and staining, but will repel the perspiration acids that make leather crack. It is especially useful with suede—notoriously hard to clean. The popular casual shoes known as "Hush Puppies" and "Lazers" are protected by it; rain and sleet tend to roll off without staining. Scotchgard-treated suede jackets now on the market are said to be adapted to normal dry-cleaning.

***A growing family tree.*** Scotchgard is only one member of a large and growing family of fluorocarbon compounds that are finding scores of new uses in forms all the way from a colorless, inert gas to supertough rods, tubes and sheets. Because of their unique virtues they have found a place in airplanes, automobiles, TV and radar stations, atomic plants, fountain pens, bakeries, kitchens and artificial human arteries.

The first fluorocarbon to be widely used was Freon, discovered in 1930 by the late Dr. Thomas Midgley Jr. who was seeking a non-toxic and non-inflammable refrigerant gas. He startled his fellow-scientists by inhaling a lungful of the gas and then blowing out a candle with it, thus proving both his claims. Du Pont

**INVISIBLE FLUOROCARBON GAS** poured into beaker by Dr. Hugh Bryce of 3M is so heavy it sinks to bottom, floating an air-filled balloon.



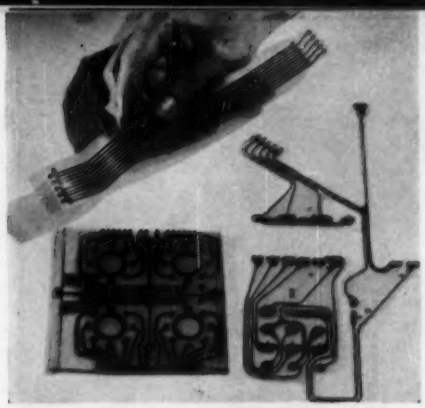

**MOTOR-OIL TEST** shows how a fluorocarbon repellent protects against stains. On treated suede, oil forms beads that can be blotted up with paper tissue. Untreated sample is ruined.

chemists found a way to make it cheaply, and it is now in millions of refrigerators.

Dr. Bryce showed me a glass pitcher that seemed to be empty. On the bottom of another pitcher rested a small balloon. He poured "nothing" into the second pitcher and the balloon rose uncannily. The first pitcher, he explained, held a fluorocarbon gas seven times as heavy as air, so it poured like a liquid. I dropped in a lighted match and the flame went out. Now this gas is coming into use as a coolant in high-voltage electrical transformers, for it stands extremes of temperature better than oil coolants, won't burn in case of leaks, and will allow transformers to be much smaller and lighter. It seems ideal for planes and missiles.

***Cooking utensils, too.*** In a Du Pont laboratory at Wilmington, Del., a chemist poured some pancake batter into an ungreased frying pan. Nicely browned, the cakes came out without sticking because the pan was lined with Teflon, a remarkable fluorocarbon plastic that Du Pont discovered 21 years ago and that is now doing, experimentally, jobs no material could ever do before. Teflon is about as slippery as ice on ice, and stands a lot of heat. Many large baking firms are using bread pans coated with it. It is also used on the end of fountain-pen barrels: It repels ink, and the barrel emerges dry from the bottle.

Because of this low friction quality, Teflon is used to coat the landing skis of some of the C-130 arctic troop carriers. The coated skis are so slippery that the planes need only a short run for takeoff; and because they repel water they will not freeze down to the landing strip overnight like wood or steel. Teflon coatings may also replace ski waxes. Dr.



**MINIATURE ELECTRONIC CIRCUITS** printed on flexible sheets of fluorocarbon resin can bend to fit tight places. The resin won't corrode, stretch, shrink, absorb moisture or melt.

F. P. Bowden of Cambridge University has timed Teflon-coated skis on several downhill runs and has found them nearly 40 percent faster than waxed skis.

***Greaseless lubrication.*** The plastic also has great promise as a greaseless, corrosion-resistant bearing for automobiles and machinery. Many new Fords now have two Teflon washers in the front wheel suspension, and the plastic appears in at least a dozen other places—as bearings, seals, or gaskets—in many cars on the road. Some engineers predict that fluorocarbon bearings will eventually eliminate all chassis lubrication points, that no grease will be used except in the transmission and the differential, and that even that will contain powdered Teflon, which cuts friction and prolongs the life of the grease.

When the Du Pont chemist put bars of copper and iron in jars containing Aqua Regia and sulphuric acid—chemicals that will dissolve almost anything—the liquids fizzled as the metals were rapidly chewed up. Then he put in bars of Teflon. They remained intact.

So chemists were not surprised when the Marines at Quantico, Va., coated the metal parts of a batch of rifles, carbines and machine guns with Teflon, dumped them in a chlorinated swimming pool, tortured others in salt-spray chambers and tropical weather chambers and found that they were still rustless and ready for use. The Marines buried other treated rifles in the sand. They not only remained rustless, but Teflon is so slippery that the Marines shook the sand off, swabbed out the bores, and fired them on the range for days without further cleaning. These preservative coatings are made in various colors, and may eventually be used to protect all manner of rust-prone machines and hand tools.

***Land, sea and air.*** Teflon films are now used in many submarine fittings in place of lubricating grease because they resist acid and sea water, last for 18 months without care and do not smear clothing. Further use of Teflon coatings, report Naval experts, will reduce the need of grease pumps and fittings to allow a weight-saving of about four tons per submarine. Teflon tubes and other parts are also used in the Convair B-58, the Atlas and Thor missiles and other fast craft because they stand up under heat and resist the highly corrosive "exotic fuels" that chew up other materials. Teflon is especially valuable as long-lived insulation for electric wiring in hot, enclosed places in fighting planes, TV and radar stations, and elevators.

Another Teflon plastic is a thin, tough, transparent film that chemists say should last 50 years as a cover for a greenhouse, carport or skylight. There are several experimental solar stills in which sea water runs through evaporation troughs covered with plastic; durable Teflon may some day be used. A Teflon cloth named "Dragon Fur," which resists fire and acids and repels water, is being tested for industrial filters. Many people owe their lives to woven Teflon artificial arteries used to supplant natural arteries in sections as long as 18 inches.

***"Hellcat of elements."*** All these stable, serviceable fluorocarbons are chemical daughters of the wildest hellcat of elements, fluorine, a yellow-green gas that will burn sand, glass, steel wool, asbestos, concrete or even water, and is extremely dangerous to touch or inhale. It was first isolated in 1886 by the French chemist Henri Moissan, who was nearly killed during his research but lived to win the Nobel Prize. As Moissan forecast, this raging tiger has two faces. Its violence is born of a desperate yen to combine chemically with everything in sight, but once the combination is effected, it has amazing stability.

Today's fluorocarbons got their big start at Columbia University, where scientists were secretly planning an atom-

[*Continued on page 254*]

## for the family car

**Home kit of puncture-proofing compound, above, can be squirted into any tube or tubeless tire through the valve. Inside the tire, the compound is said to form a thin, even film that instantly seals nail punctures, slow leaks or rim pinches. Security Sales Co. sells the kit with dispenser and enough compound for four tires for $9.95.**

In recent tests, at right, tires containing the new sealing compound were pincushioned with nails. Then the nails were removed and the tires dunked in water, with no loss of air. The self-sealed leaks were also road-tested for 10,000 miles at up to 95 m.p.h., and at this point were still going strong.

A flexible contact strip, placed around the walls of your garage, guides your car in and out by flashing a warning light if your tires touch the strip at any point. The device, sold by Ease-In, connects to any 110-volt outlet . . . You may soon see more aluminum on cars. Alcoa has an aluminum-finned radiator, not yet on the market, said to cost and weigh 20 percent less than present types. Aluminum bumpers, already on buses, are also on the way. They're designed to lighten front-end weight. . . . Dashboard reminder flashes

if you forget to turn your headlights off. It's wired into the circuit in such a way that it goes on only when you switch off your engine without switching off your lights. Unitron Corp. makes the accessory for six- or 12-volt systems.

**New two-way lantern serves as spotlight or trouble light with its swivel head turned upward (above, left), or as a camper's lamp with the head turned downward (right). Ray-O-Vac sells it with six-volt battery for $8.95.**

You can add pushbutton windows to any 12-volt car with a kit put out by AMT Corp. Priced at $34.50, the power controls are said to to take less than an hour to install and do not require removal of door panels.

## what's new in tools

**New type of wood- or metal-working clamp, at left, works like a C clamp, but is said to have the advantages of parallel-jaw types. The offset adjustment screw, at an angle to the jaws instead of in line with them, prevents the clamp from twisting or "walking off" as it's tightened and also keeps the work area free of obstructions. Pivoted jaw blocks provide either flat surfaces or V grooves for gripping round stock. Custanite Corp. sells the clamps in sizes from 1″ to 13″ for about $2 and up.**

Extra-large-size drill bits in the flat, spade-type design are now available from Irwin. Four new sizes range from 1⅛″ to 1½″, but still have ¼″ shanks for use in ¼″ electric drills. Price is $1.25 each . . . New Keuffel & Esser tape rules are marked in two scales so you can easily read either total running inches or feet and inches. They're available in 6′, 8′, 10′ and 12′ lengths . . . Another maker of tapes, Lufkin, is now selling a 50-foot rule together with a small six-footer for the kitchen workshop for $5.95 . . . You can build your own 12″-capacity bandsaw from a new kit costing only $24.95. The kit includes band wheels, bronze oilite blade guides, ball

thrust bearings, 78″ blade and all other mechanical parts. You add your own motor and a wood housing. Gilliom Power Tools sells it.

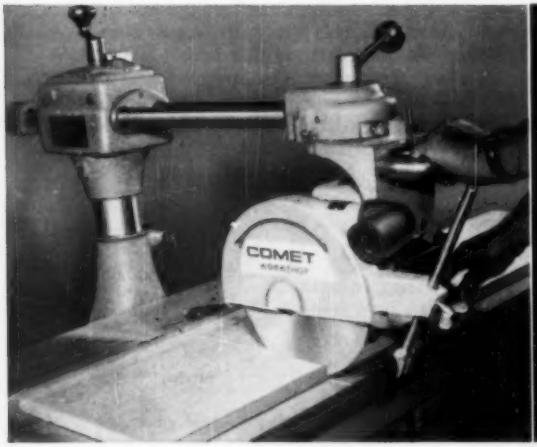
**Inexpensive parts bin, at right, stands 18″ high and has four 12½″-diameter rotating trays. Walker Mfg. Co. sells the metal bin for $9.20.**

A portable 90-amp electric welder, made especially for use in the home shop or garage, will operate on either 115- or 230-volt AC current. Its maker, Emerson Electric, sells it for $84.50. A heavier-duty 180-amp welder is also available for $155 . . . Vaco's line of pocket nut drivers now offers a new two-ended model that has a ¼″ hex socket at one end, a 5/16″ socket at the other end, to give you two tools in one. Price is $1.

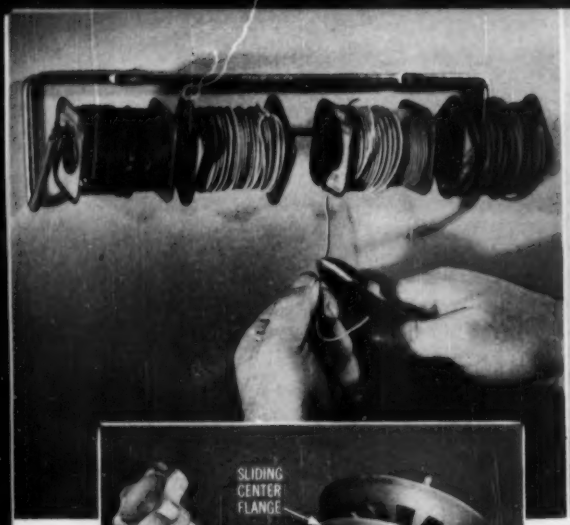
**Doweling jig, at right, makes it easy to drill accurately matching dowel holes in mitered frames. Stock up to 1¾″ thick is clamped in the jig, then a sliding guide on top positions any of four ¼″ hole locators over the stock. Ashley's sells it for $3.98.**

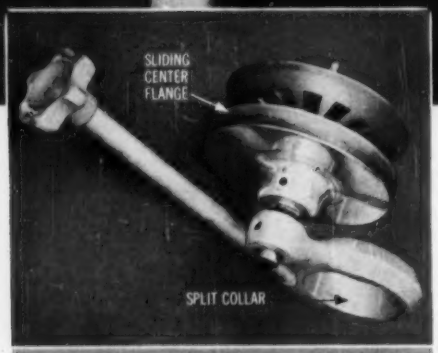
Comet's fancy new radial-arm saw, announced in POPULAR SCIENCE last month, is shown in use below, at left. Now on sale, the saw swings a 9″ blade. Its one-hp. motor is said to provide a full two hp. under load. Its unique arm design has twin chrome-plated steel tubes that ride in and out on eight ball bearings for smooth, rigid operation. The saw will sell for $239.

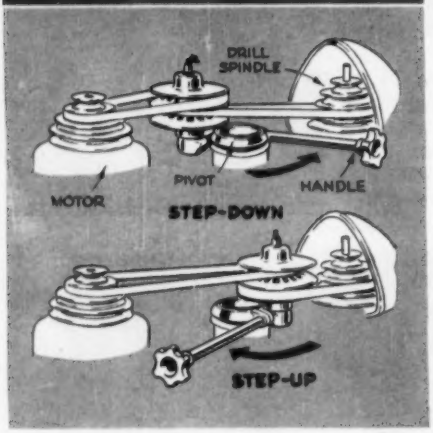
**A brand-new portable circular saw called the Artisan, at lower right, is being introduced for the first time by the Gamble-Skogmo chain stores. The 6½″ saw is rated at a husky 7.5 amps, has an anti-kickback slip clutch. Priced at $49.95, it weighs 10½ lb., has a cutting depth of 2¼″ at 90 degrees, 1⅞″ at 45 degrees.**



*Please turn the page for more new products*





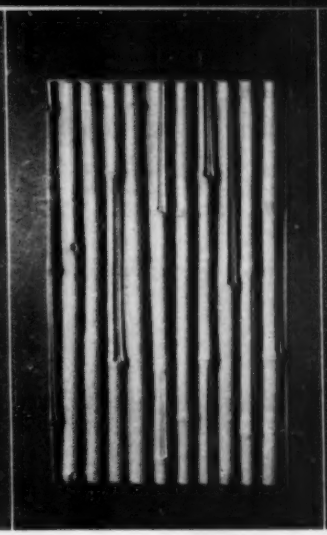

**Spools of hookup wire, at top left, are within instant reach on handy metal racks that you can hang on a toolboard or mount on a bench. The racks come in 14 assortments from Belden Mfg. Co.**

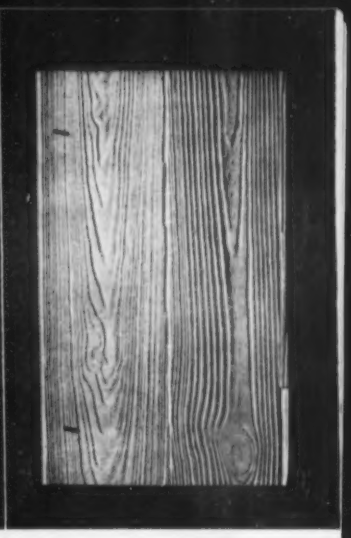
You can change drill-press speeds in smooth, continuously variable ratios, instead of fixed steps, with the speed-varying device at left. It mounts on top of the column between the motor and spindle and has a sliding center flange that changes the diameter of the driving and driven pulleys depending on which way the handle is turned. Made by Custanite Corp., the changer has an overall ratio of 6.5:1, sells for $18.

**Latest shape in hand sanders is the unusual tough-plastic model above, at right. Its planelike handle with extra knob lets you grasp it with one or two hands. Its base provides a broad 3¾″-by-7″ sanding area. Although especially designed to use long-lasting tungsten carbide abrasive, the Sunbeam Quick Sander will also take other types of sandpaper. Price is $2.95.**

## for more information:

*Here's where to write if you can't get any item listed:* **Alcoa,** *1501 Alcoa Bldg., Pittsburgh;* **AMT Corp.,** *200 Briggs Bldg., Birmingham, Mich.;* **Ashley's,** *49851 W. Huron River Dr., Belleville, Mich.;* **Belden Mfg. Co.,** *4645-T W. Van Buren, Chicago;* **Comet Mfg. Co.,** *2033 Santa Fe Ave., Los Angeles;* **Custanite Corp.,** *1228 Utica Ave., Brooklyn, N.Y.;* **Decro-Wall Corp.,** *21 Saw Mill River Rd., Yonkers, N.Y.;* **Ease-In,** *P. O. Box 32, Northville, Mich.;* **Emerson Electric,** *8100 Florissant Ave., St. Louis;* **Gamble-Skogmo,** *15 N. 8th St., Minneapolis;* **Gilliom Power Tools,** *P. O. Box 6157, Lambert Field, St. Louis;* **Irwin Auger Bit Co.,** *Wilmington, Ohio;* **Keuffel & Esser Co.,** *Adams and Third Sts., Hoboken, N.J.;* **Lufkin Rule Co.,** *Saginaw, Mich.;* **Ray-O-Vac Co.,** *Madison, Wis.;* **Ronson Corp.,** *1 Ronson Rd., Woodbridge, N.J.;* **Security Sales Co.,** *1093 Broxton Ave., Los Angeles;* **Sunbeam Corp.,** *5600 Roosevelt Rd., Chicago;* **Unitron Corp.,** *P. O. Box 235, Dade City, Fla.;* **Vaco Products Co.,** *317 E. Ontario St., Chicago;* **Walker Mfg. Co.,** *1505 Broadway, Cleveland;* **Westinghouse,** *Bloomfield, N.J.*





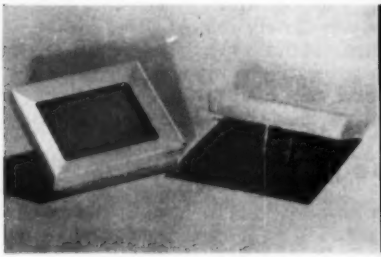
# what's new for home improvement and upkeep

New plastic wall paneling, above and at right, simulates stone, bamboo, wood plank and other designs in thin sheets easily cemented to any surface. Decro-Wall sells them in natural and two-tone finishes for 50 cents to $1.30 a square foot.

**Portable plug-in electric shoe polisher, at right, is latest item by Ronson, famous for its cigarette lighters. Priced at about $20, it comes with two brushes and a buffer.**

New type of night light, below, is first electroluminescent "flat bulb" made public by Westinghouse. A tiny square of phosphor-coated glass, it plugs into any outlet, glows endlessly on less than a penny's worth of power a year.

Sheldon Gallager



*Every year U.S. companies shell out $20,000,000 for employees' suggestions. That's just one small part of the payoff for getting bright ideas on the job. Here's how to rev up your idea-generator*

# Boosting Your Output of Good Ideas

**By Max Gunther**

YOU'RE riding home from work, or cleaning the garage, or shaving. Suddenly it hits you: "Hey! Why don't I . . ."

You've got a bright idea. It came from nowhere. You weren't hunting for it. But here it is, a diamond dropped in your pocket by nobody, for nothing. It's an idea for making extra money, or solving a problem, or simplifying your job, or face-lifting your house. Or maybe it's an idea for a gadget or a part-time business.

When will you get another idea like that? No telling. Bright ideas—really bright ones—don't come often. They don't, that is, unless you know how to make them. And you can learn how.

History is full of men who had that incalculably valuable knack. Edison, who started with little education, ended with 1,200 patents and a tidy fortune. On a smaller scale—there's the guy at Remington Rand who collected 300 times on ideas he dropped into the suggestion box.

These are the men who move ahead. Says General Electric: "We're always hunting for idea men. No big company can stay alive long without them." One indication of the value of ideas: the $20,000,000 given away by U.S. companies every year for employees' suggestions.

You can cut in on the bright-ideas benefits yourself, whether it's to impress the boss, get a better job, hit the suggestion-system jackpot or just make things run more smoothly at home.

For today, the art of creating ideas is close to a precise science. Psychologists have analyzed it. Big companies that live on new ideas have spent millions refining it. Their conclusions:

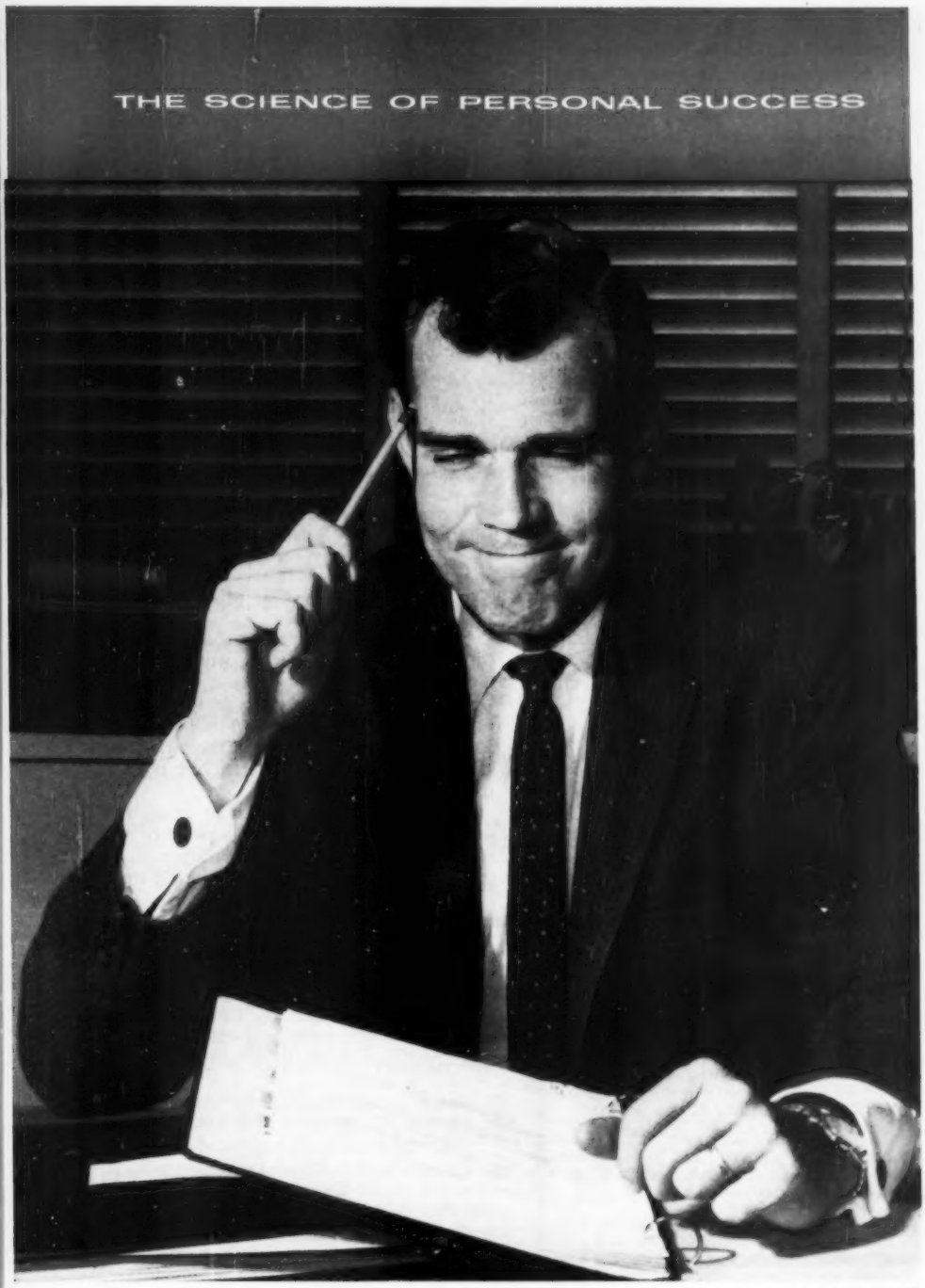
- You get bright ideas by combining old ideas in new ways.
- You can improve your ability to do this without much effort.

You may find a course on ideas being offered by your company or a local college. If not, ask your librarian for Alex Osborn's book, *Applied Imagination*, or Charles Whiting's *Creative Thinking in Management*. Both are written with businessmen in mind, but anyone can use their teachings in any area of life.

Or you can train yourself. There are only two closely related things you need to understand: (1) how to make your idea-generating equipment turn over faster, and (2) how to shove aside mental blocks so that your ideas can come out.

## The generator

Natural-born idea men, tests at the University of Chicago showed, are likely to


THE SCIENCE OF PERSONAL SUCCESS

be people who have trouble making friends, who show a "need to retreat" from the human world into the world of ideas, machines and things. But everybody has the mental equipment to generate ideas and can speed up the process.

To do that, you must consciously push. "Like a machine, the creative part of the mind suffers from inertia," says Willard Pleuthner, vice-president of Batten, Barton, Durstine & Osborn, big New York ad agency that has done much of the thinking about idea-getting.

"The first step for any individual or group in need of ideas," he says, "is to define precisely the kind of ideas wanted. Then *set a definite quota and time limit*—so many ideas in so much time. Without this deadline, we've found, the mind just doesn't function at top efficiency."

Suppose you want extra cash for your vacation. You need ideas on how to get it. Pick a quiet time of day and a comfortable chair, or tackle some easy job around the house that doesn't take much thought. Put a pad and pencil nearby. Tell yourself: "I want 10 ideas by noon." Probably to your own surprise, ideas will chatter out of your head like machine-gun bullets. "You'll get more ideas this way," says Pleuthner, "than in a week of moping around, waiting for ideas to come."

## The blocks

Once the ideas start flowing, you have to keep them alive—at least until you know whether they're any good. Most people don't. They kill them off the instant they're born with what psychologists call inhibitory mechanisms—mental blocks.

You can get around the blocks (and save good ideas) if you watch out for them. Among the commonest idea killers:

***Timidity.*** Your mind usually allows too big a margin for error. Walter Brzoza, creative-thinking expert at General Electric, illustrates this block with a closed, empty box the size of a shoe box. Almost always, says Brzoza, people asked to guess its contents list things so small that they'd fit into a box a tenth that size. Anything bigger than a pack of cigarettes seems risky and the mind blocks it. To hurdle this block, force yourself to take rash, even wild chances—mentally, that is.

***Tradition.*** Your mind rejects ideas if they reverse the way things are usually done or trample on cherished feelings. In a classic demonstration of this block, a

group of MIT students was shown an iron pipe bolted upright to a wooden base. Down inside the pipe was a Ping-pong ball. Nearby on a table was an assortment of tools and a rusty, beat-up pail of water. Problem: Get the ball out of the pipe. The students figured it out fast: They poured the water into the pipe.

Then a second group was given the same problem. This time, in place of the rusty bucket there was a sparkling-clean pitcher of ice water with a drinking tum-

### 7 Tips to Trigger Good Ideas

You can make your brain crank out better ideas faster, says Alex Osborn, author of *Applied Imagination*, by asking yourself questions about the problem at hand. Some samples:

1 Can it be done backwards? Upside down? Inside out? (Maybe you could commute faster by driving the wrong way a mile, then picking up the expressway.)

2 Can you borrow an idea from some other line of work? (Maybe you could hear what's wrong with that machine by using a doctor's stethoscope.)

3 Can you substitute something? (Glue for nails, wood for metal, die-casting for machinework—or vice-versa.)

4 Can you leave something out? (Why lay expensive flooring if it's to be covered with carpet?)

5 Can you add something? (Will an extra storage chest ease the load in overcrowded closets?)

6 Can you make it bigger? Smaller? Stronger? Weaker? Heavier? Lighter? (Maybe you should beef up a drill motor so it can drive big accessories.)

7 Can you do it more cheaply? (Does the inside need the same finish as outside?)

bler. The students tried everything but the water. Seeing it in the pitcher, they associated it so strongly with drinking that they couldn't think of its other uses.

This mental block often disappears if you purposely "turn things upside down."

***Visual block.*** Once you've seen a thing one way, you have a hard time imagining it any other way. To illustrate this, GE's Brzoza takes one group of men and shows them arty drawings of flower vases. He shows a second group drawings of faces. Later, he brings the two groups together and shows them a single vague picture. One group says it's a vase; the other says it's a face. Again the cure is the conscious search for something different.

***False requirement.*** Your mind fences off whole areas of ideas by assuming requirements that don't really exist.

This block almost upset a good-will gesture a few years back. Connecticut children had been presented a baby elephant by children in India. Problem: How to raise $1,000 to bring over the elephant.

Adults and kids stewed over the problem until someone broke through the mental block and pointed out that the true requirement was not money but transportation. Sure enough, an airline agreed to deliver the elephant for nothing.

## Idea techniques

The experts have worked out new idea techniques that remove blocks at the same time they speed up your creative mind. Most famous is "brainstorming," formulated in 1939 by Alex Osborn, cofounder of BBD & O. Its main principles:

1. Rule out all critical judgments during your idea-getting session. If it's a group session, make it absolutely against the rules to criticize any idea, or laugh at it, or deflate it in any way.
2. Welcome wild, ridiculous ideas.
3. Concentrate on quantity. Forget quality. Don't stop to assess ideas. The sole object is to get as many on paper as possible.
4. When the brainstorming session is over—and only then—go back over the list and begin judging the ideas.

One classic example of brainstorming concerns the group that set out to solve the dishwashing chore. Prize solution: Use edible dishes and eat them after din-

[*Continued on page 240*]

### Can You Break the Blocks That Lock Up Ideas?

INGRAINED thinking habits often kill some of your best ideas—before you can judge them fairly. These brain-teasers illustrate how. The answers are easy, once you break the mental block.

**1. Tradition Block**

You have three buckets. One holds six quarts when brim-full; one holds three; the other, two. The six-quart bucket is filled with water. The three is empty. The two is filled with gasoline. Because of the shape of the buckets it's impossible to tell when one of them is half full. Problem: With no other equipment, and without dumping out anything on the ground, measure a roughly accurate quart of water in one of the buckets.

Hint: You can't do it the way liquids are *usually* measured.

**2. Visual Block**

In each of these figures, draw *four straight lines* that pass through all 12 dots, without taking your pencil off the paper and without backtracking.

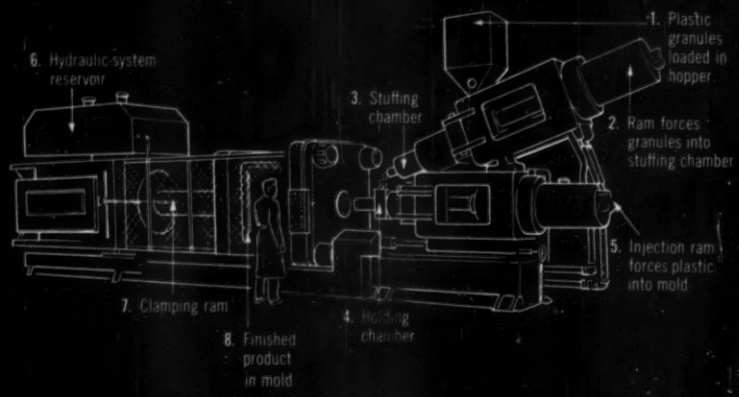
Hint: You'll have to visualize the figures in different forms.

**3. False-Requirement Block**

Here's another figure of dots. Connect the dots in the same way with *five* straight lines.

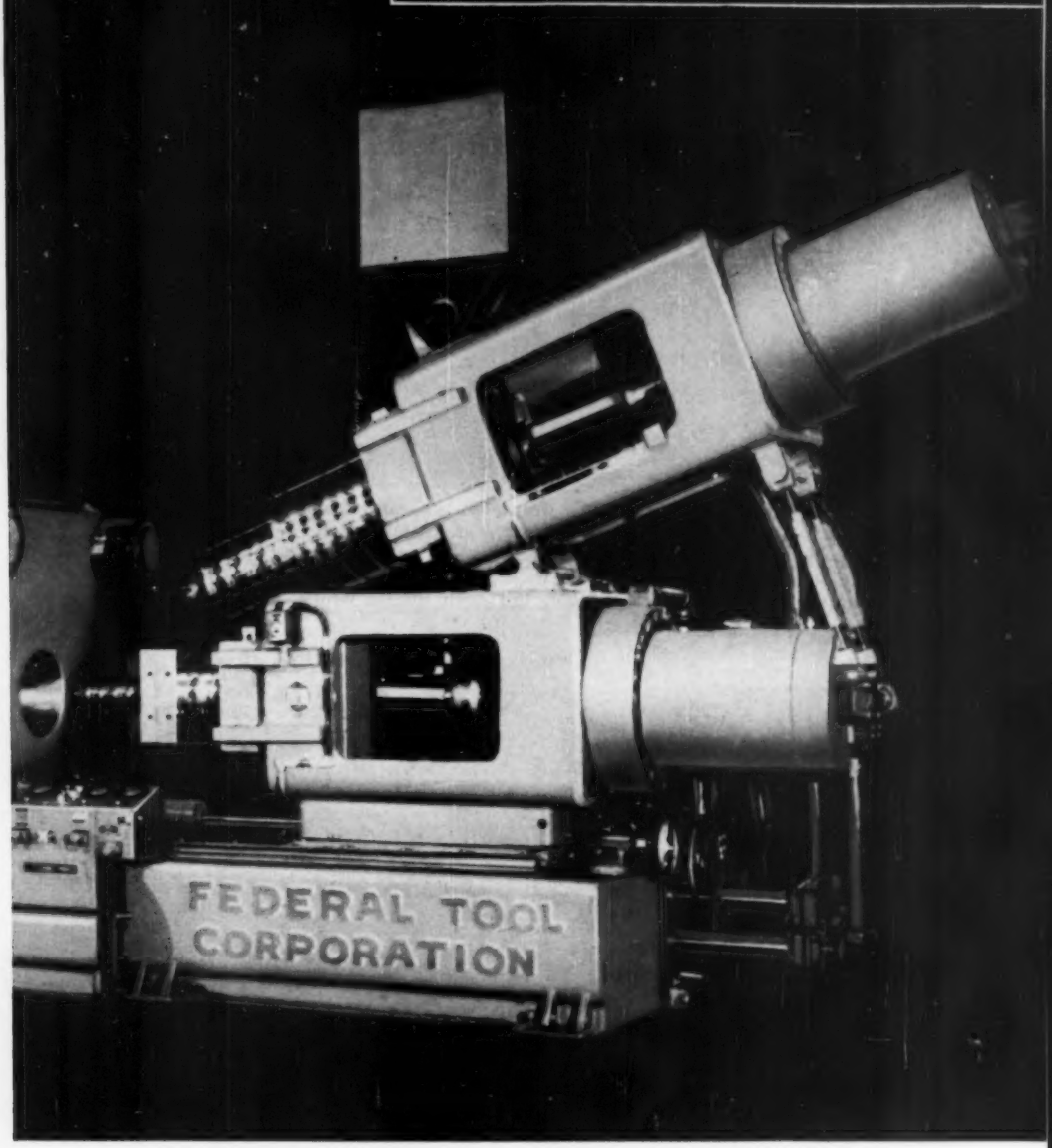
Hint: Watch out for a requirement that you think exists but really doesn't.

*For answers, see page 242*



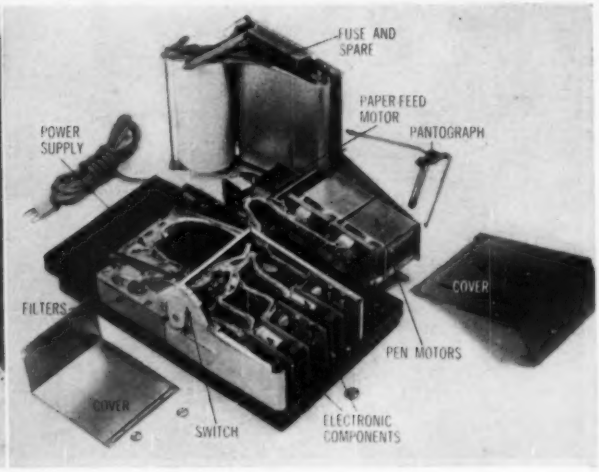

**Mammoth molder.** From plastic granules loaded in its hopper, this huge $150,000 injection-molding machine turns out household laundry baskets (above), trailer bathtubs, 55-gallon drums and the like in rapid-fire automated mass production. When the operator punches a button on his control board, plastic is forced into a holding chamber and rammed

# Picture News
IN THE WORLD OF SCIENCE

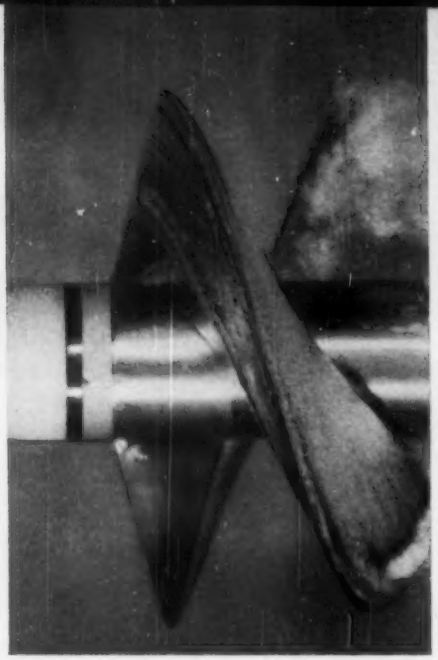



into the mold with a clamping force of 1,500 tons. The big machine, in use by Federal Tool Corp., Chicago, occupies 12 by 36 feet of floor space, weighs 215,000 pounds, accommodates molds up to four by six feet in area, handles up to 300 ounces of plastic per cycle. There is said to be but one other of its size and productive capacity in the world.

**Hockey-playing mice.** To dramatize its control mechanisms, a British electronics firm built this device in which mechanical mice play ice hockey with unpredictable results. The puck is a light, and each mouse has a scanning photocell in its head. Polarizing circuits, plus lines of force beneath the table, tell each mouse which goal to head for.

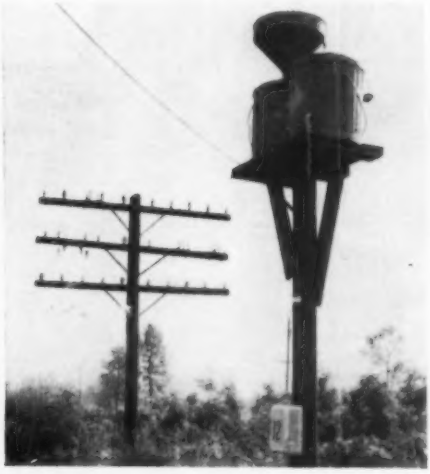



**Writing by wire.** Doodle or scribble on the pad in this new machine, and your message is transmitted by telephone wire to other machines in the circuit. Working something like teletype, Comptometer's Electrowriter sends handwriting, diagrams and drawings instead of type. You simply mark the pad with a linkage-connected pen. Radio can also be used.

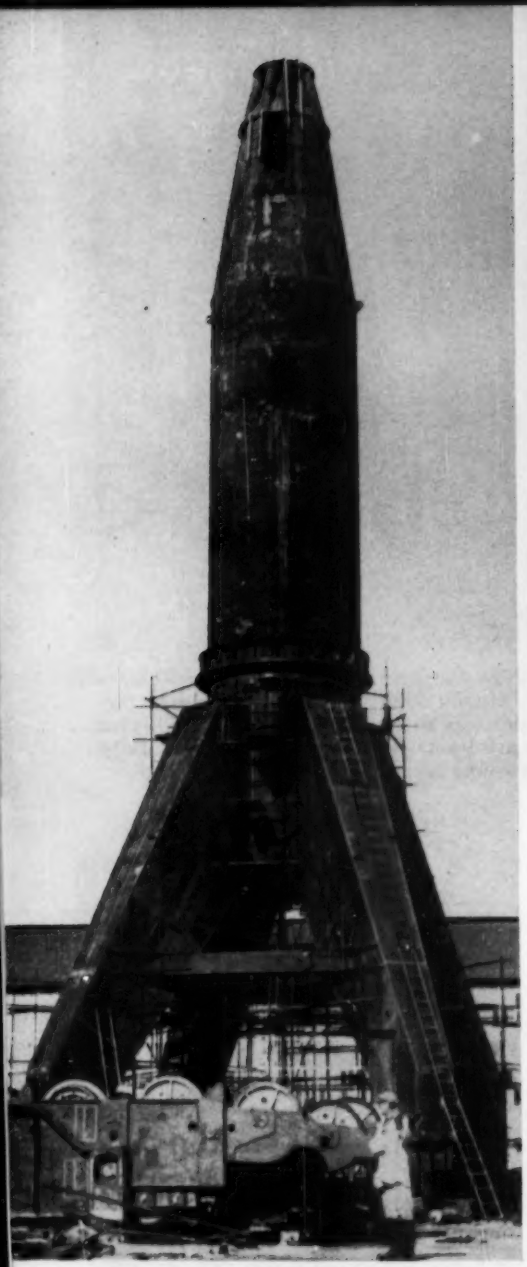


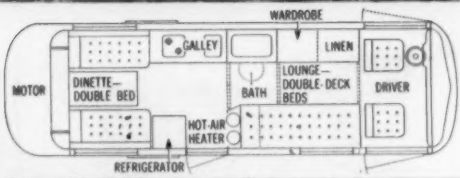
**More "push" for ships.** Warships that streak through the water at 60 to 70 knots—almost double their present 30 to 40 knots—may soon be possible with spiral, one-bladed props as at left. Conventional multi-bladed ones (right) are limited by cavitation, the formation of vapor bubbles that impair efficiency. The new one uses bubble drag to advantage.

**Drive-in grocery.** This shopping window in a supermarket in Linden, N.J., enables a customer to phone in his order, pick it up without waiting. Or he can hand in a list, park until it is filled.



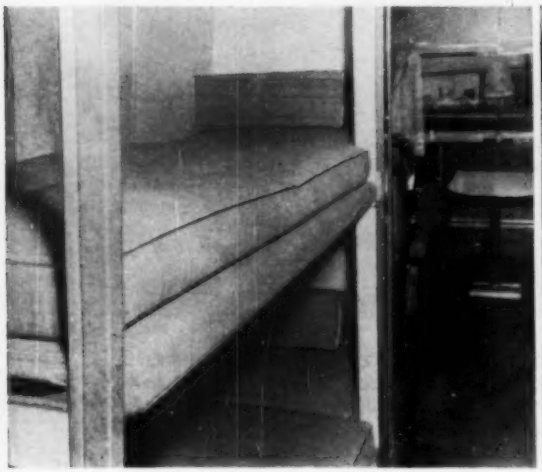
**Ash cans in the sky.** No joke, these trash cans on poles at Mobile, Ala., are rain collectors. It's part of a Bell Labs study on the effect of rain or snow in the air on microwave transmission.



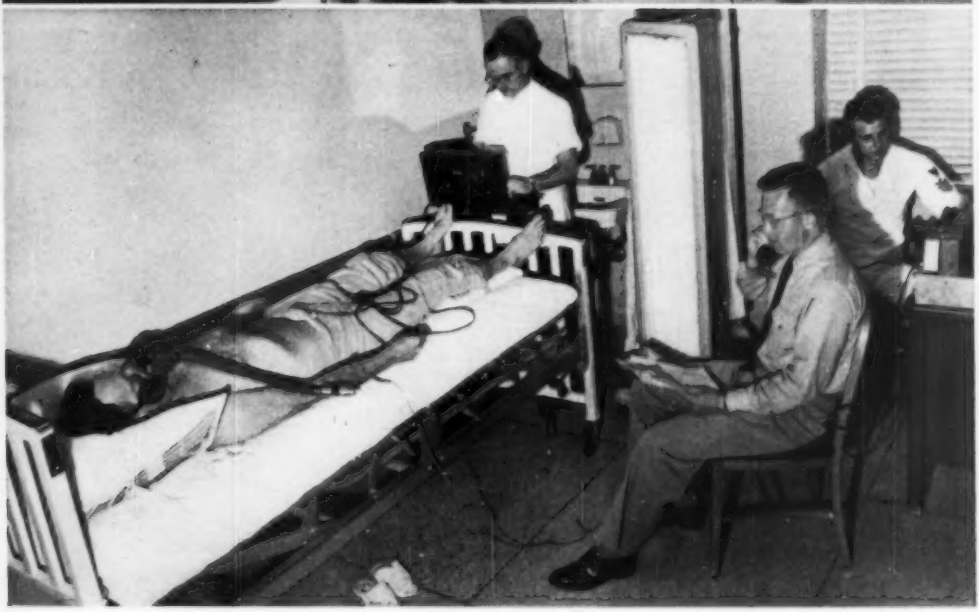


**Earthbound "rocket."** Looking like a rocket or missile all set for launching, this towering structure is actually the central pivot that swings the long boom of a new 120-ton shipyard crane. The big crane is under construction at La Ciotat naval yard in southern France.

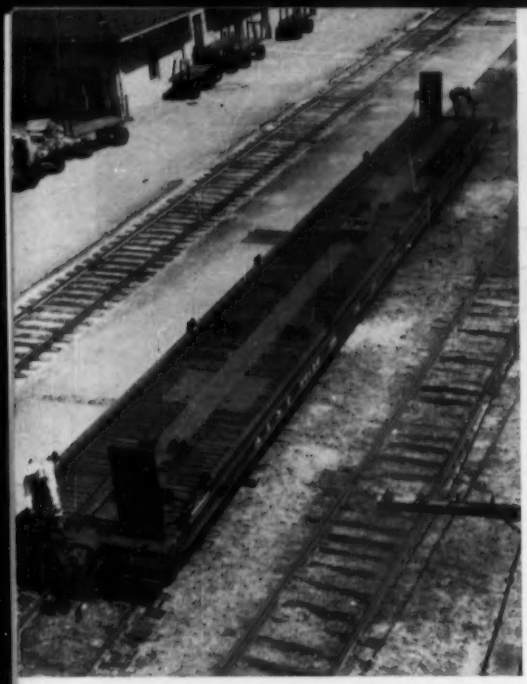
**All-in-one mobile home.** Here is a trailer that doesn't hitch behind the family car; it's powered by a rear 106-hp. Ford V-8 engine. Under seven feet wide—2½ inches more than the 1959 Buick—and 23½ feet long, it cruises at 60 m.p.h. Below, left to right: seat by day, double bunks by night, and a lounge-dinette (with refrigerator and range) that becomes a double bed. The maker is Land Yachts, Des Plaines, Ill.



**For footsore San Franciscans.** Instead of trudging up steep stairways, these residents of California's hilly city ascend from garage to home on private elevators. The little hill climbers are similar to the cable cars that made San Francisco famous. They were invented by Sherman A. Camp, president of Dwan & Co. of—yes—San Francisco.



**Diagnosis by wire.** Doctors in the Kansas City General Hospital watch an electronic monitor (top, left) to diagnose the condition of a patient (lower photo) halfway across the country in the Bethesda, Md., Naval Hospital. Wires from the patient's body and a respiratory mask transmit data through telemetering equipment. A case history is given by phone.



**Piggyback stretchers.** The longest flatcars ever built, these 88-foot stringbeans haul two 40-foot trailers each. The Santa Fe is adding 25 of them to its rolling stock.

Securing devices shown on the center strip of the empty car at left are positioned to lock trailers in place for the rail journey. The upended leaves at front and back lower to form ramps for moving the trailers from car to car on a train.

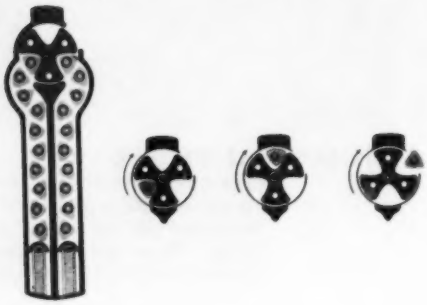
**Back-seat piloting.** Deckhouse and engines of this new 15,000-ton supertramp steamer are as far aft as possible, leaving the midship and forward sections free for hatches and booms. This "everything-aft" design for big freighters is called one of the most significant advances since World War II Liberty ships. The World Japonica, one of three of her class built in Japan, is operated by Transoceanic Marine of the Niarchos group.

**Prefabbed street.** Fitting giant paving blocks together like parts of a jigsaw puzzle, workmen here use a special crane to fashion a prefabricated street in Stuttgart, West Germany. The two-ton blocks of concrete are rabbeted on the edges so they lap over each other and form a neat seam. Then asphalt is poured on to make a finished roadway. It saves about five weeks over ordinary paving methods.

**Plastic bullets.** The firepower of an automatic with the simplicity of a revolver are claimed for this gun. Its inventor, David Dardick, combined the two—and licked the gunsmiths' dilemma of the "open" chamber—by designing triangular cartridges. These, in wedge-shaped openings in the cylinder, resist rupture as round cartridges do not.

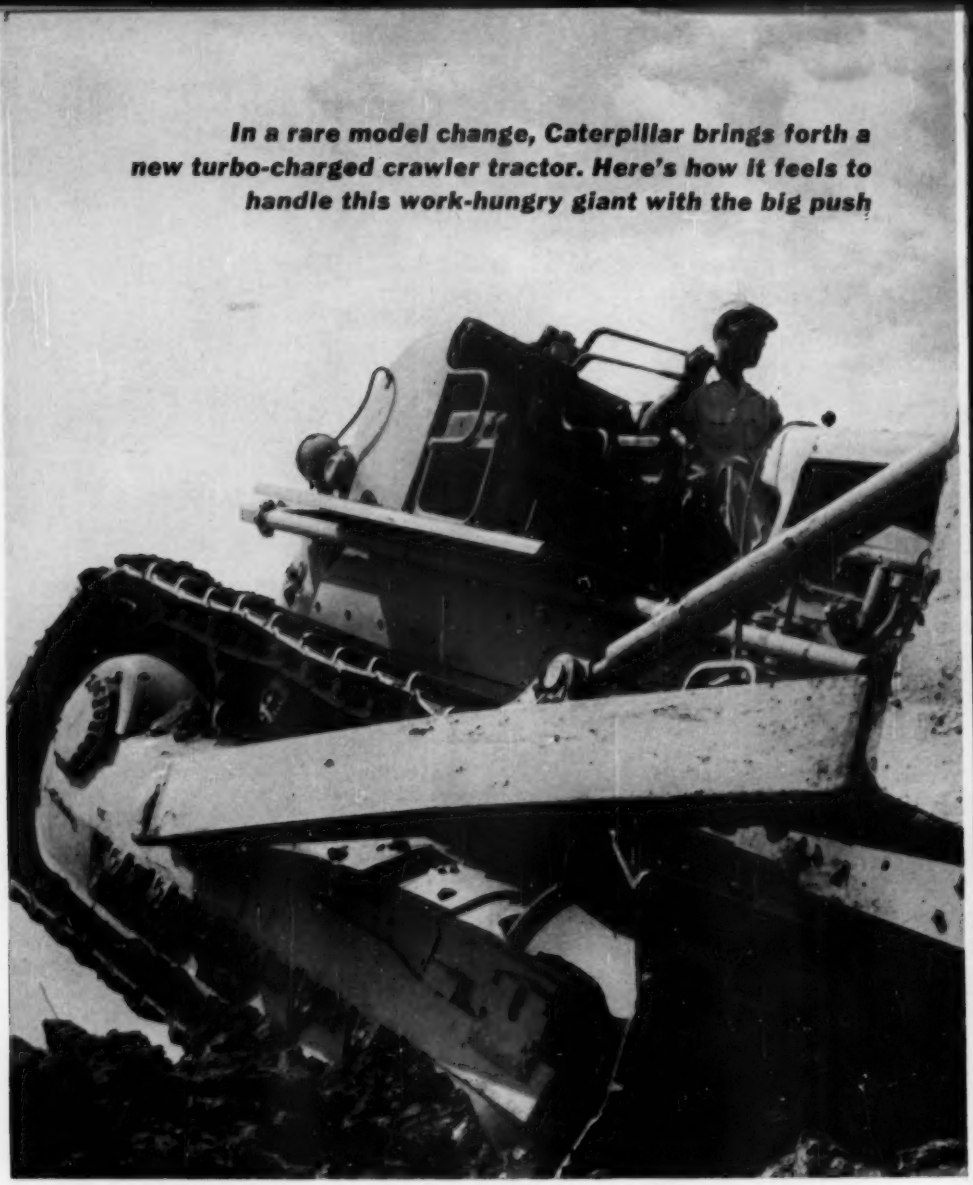
Plastic-cased cartridges ride up the magazine by spring action (see diagram). As the trigger is pulled, the cylinder rotates and picks up a cartridge. At the next pull, it's rotated into firing position. Next pull, it's fired and ejected.

Barrels, .22 or .38, are interchangeable. With the barrel removed, the gun can be inserted in a rifle-stock assembly. The model shown takes a 20-round magazine; others take 11 or 15. Dardick Corp., Hamden, Conn., makes them.



**Rubber road.** An 18,000-foot rubber conveyor belt will move 20,000,000 tons of fill down a mountainside to a dam under construction in California. Here, Goodrich engineers unroll the 42-inch-wide belt at the Trinity River site, start of its 850-foot descent from the peak.

***In a rare model change, Caterpillar brings forth a new turbo-charged crawler tractor. Here's how it feels to handle this work-hungry giant with the big push***

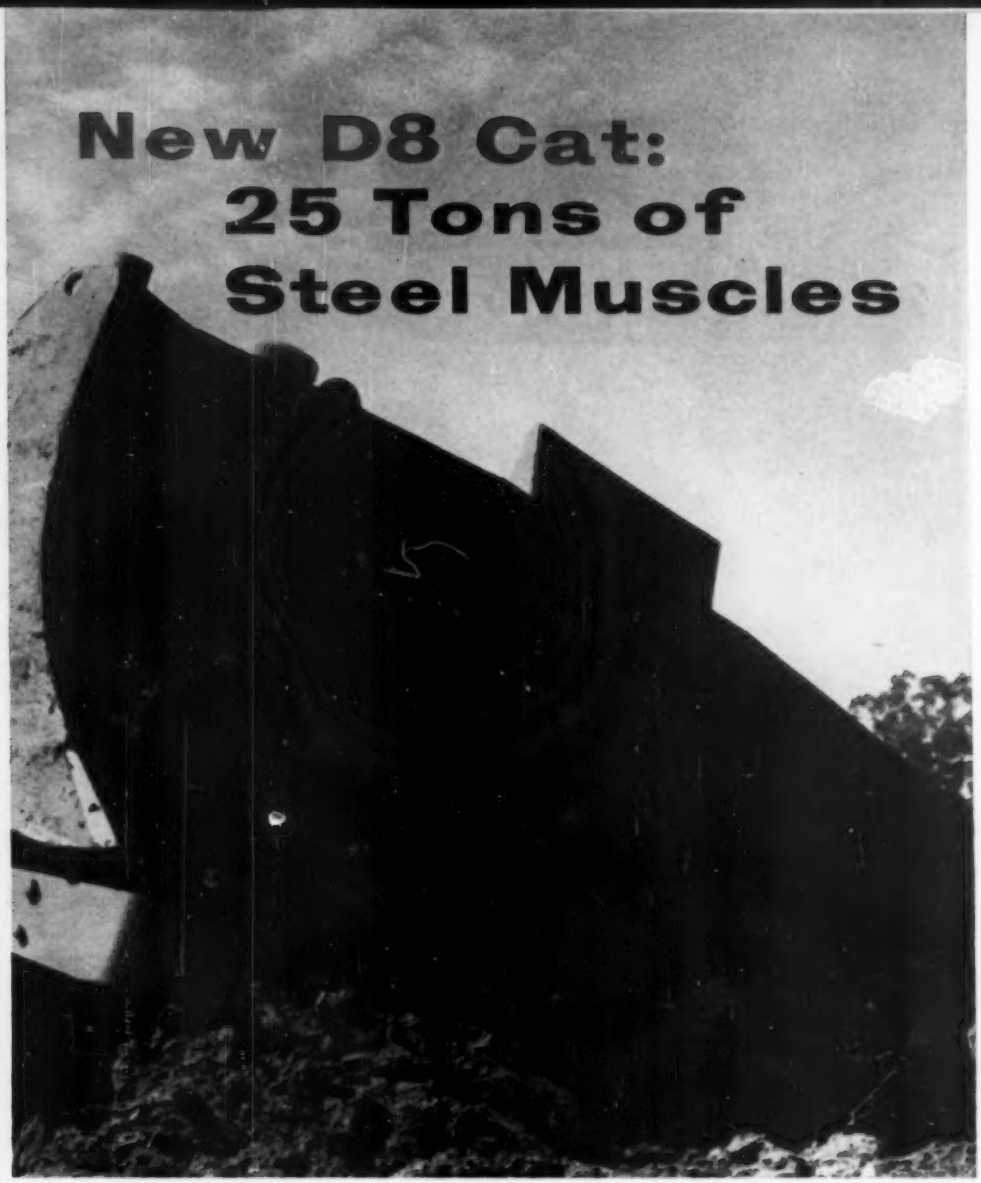


**By Harry Walton**

LAST year four experimental new crawler tractors were shipped to different parts of the country. Clearing land in Florida, strip-mining coal in Pennsylvania, helping to build a dam in California, mining copper in Arizona, they were watched closely by company men while they showed what they could do, flexing their muscle on actual jobs.

More recently, another was placed at the disposal of POPULAR SCIENCE at the Peoria proving grounds of the Caterpillar Tractor Co. A skilled operator put it through its paces for the camera. Coached by him, I took the controls myself. Here's the story of this new D8 Cat and how it feels to move earth with 25 tons of motorized steel in your hands.

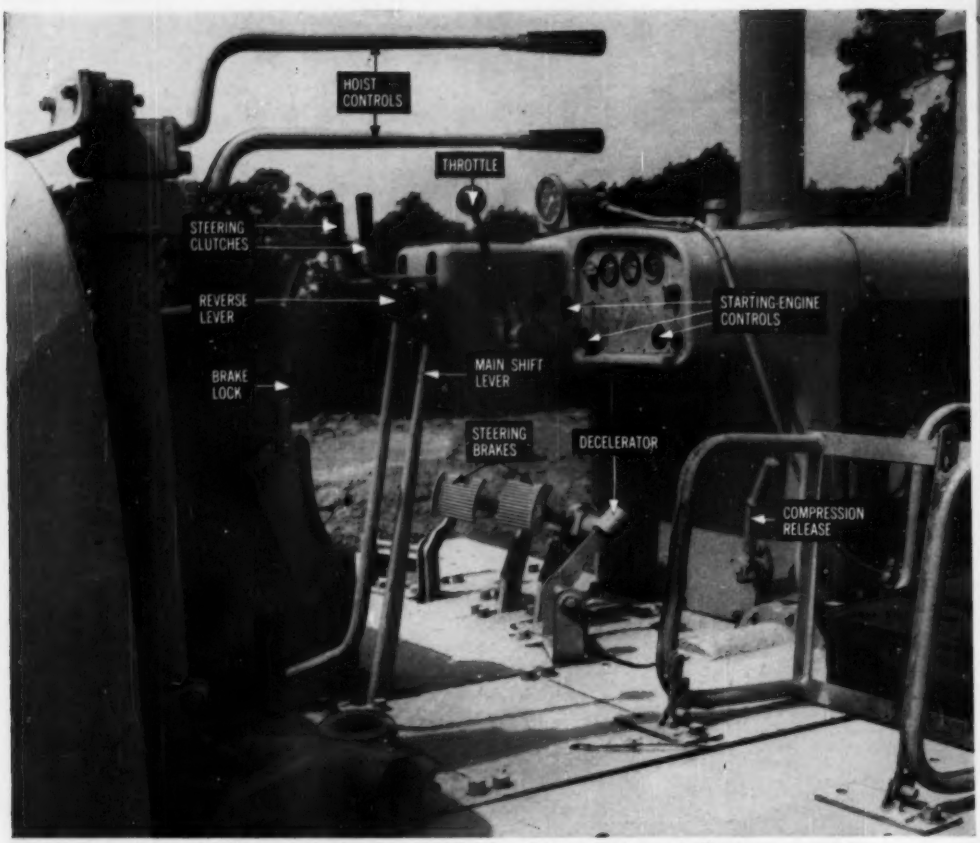
# New D8 Cat: 25 Tons of Steel Muscles



New models are rare in earthmoving machines. Individual parts are improved, but the machine usually doesn't look different. Moreover, bigness and more engine horsepower will sell a machine only if it can do more work.

That's the reason for the new D8. It can do even more work, or do the same work faster, than its able predecessor. It will pay its way on a contractor's books by moving more earth per hour of time or dollar of operator's wages.

But this is only one view of a fascinating piece of mobile machinery. It's a vehicle that could tow behind it a string of stalled automobiles more than five miles long. It can operate in water five feet deep, or in 50-below cold, and it seems to *enjoy* shoving a 13-foot wide, 25-ton pile of earth ahead of it. Teamed with a scraper,




**PLENTY TO HANDLE:** Two hoist controls raise or lower blade or shovel at either end of machine. Instruments are water and oil gauges, ammeter. Tachometer on top is not standard equipment.

it can push-load 27 tons of earth in 40 seconds.

It's bigger, heavier, huskier. The new machine weighs 4,480 pounds more than previous D8 models. In sheer bulk the big crawler dwarfs a full-size car. Its six-cylinder diesel whomps out 225 honest-to-Pete horsepower at what would be little above idling speed for an auto engine. Its drawbar horsepower is 180; drawbar pull is 52,250 pounds (Drawbar horsepower of the previous D8, no weakling itself, was 155).

***Our first glimpse of the new D8*** was inside a cloud of proving-ground dust. As it clanked to a stop, the operator throttled its diesel back to a mere thunderous chuckle and grinned down at us.

"Go ahead," said staff engineer Tom Geselbracht. "Climb up and drive it."

Up on the deck, I shook hands with six-foot Bill De Boeuf, who looks more like an Olympic swimming champ than the skilled operator he really is. He motioned me into the comfortably padded driver's spot, while he moved over to a jump seat alongside.

Up here, near the exhaust stack, engine noise was louder. The deck seemed to bristle with levers, pedals and handles. Bill ran over them briefly, then waited for me to drive off.

"How about first showing me how you start the engine?" I hedged.

He shut the throttle and the huge diesel died. "Some engines come with electric,

air or inertia starters," he explained. "This one has a gas engine to start the diesel. The gas engine has an electric starter, same as in your car."

He turned on a gasoline valve in one corner of the small instrument panel and an ignition switch in the opposite one. Then he punched the starter button. A two-cylinder engine bustled into action, its exhaust a puny yip compared to that of the now silent diesel.

Next he swung back a handle down near the deck. "This is the compression release," he said. "When starting cold, you leave it open until the oil limbers up and the diesel is turning over freely."

***Pulling out the gas-engine throttle,*** he engaged the starter pinion by tugging a handle on the left of the steering clutch levers and flipped the compression-release to "run." The two-lunger shouldered into its load, began to turn the big crankshaft. Huge pistons gulped air, compressed it to ignition temperature. Injected oil flamed into explosion and the already warm engine instantly caught. Its throaty rumble all but drowned out the yip of the starting engine before Bill cut the ignition of the latter and shut its fuel valve.

"That's all there is to it," he shouted. "Now that long handle on your left controls the flywheel clutch. The first one on your right is the forward-and-reverse lever. Next one on this side is the main transmission shift."

A diagram on the instrument panel showed six speeds each side of neutral. I shoved the clutch lever forward to disengage position, manhandled the main shift lever into first gear (it was the only control that took any real effort), pulled the forward-and-reverse back into forward, and tried the brake pedals on for size.

***Then I opened the throttle.*** With a willing roar the diesel sped up to its full governed speed of 1,200 r.p.m. The deck thrummed. I eased the clutch lever back over center and the D8 took off, gear and track sounds unheard above the engine. With a feeling of slow but inexorable movement we lurched down a small slope.

POPULAR SCIENCE photographer Bob Borst immediately walked around in front of the left track, eyes glued to his Rolleiflex. He never heard me yell. I hastily yanked out the right-hand steering clutch, but nothing happened. Still in the way, Bob cranked his camera for another shot.

A tap on my shoulder and I saw Bill pointing to the right-hand brake. I slammed it on. The right track stopped and we spun around on it. Looking up as if he'd lost a picture, Borst sidestepped until he was again in the way. I had to turn once more, learning what any crawl-

**NEW D8 LOOMS HIGH** above four-door hardtop. The mighty earthmover is 17 feet long, almost eight feet high, more than nine feet wide. Dozer blade, 13 feet across, weighs four tons.

## *How to carve out a road in less than 30 minutes*

Rugged going for this Jeep is transformed . . .

. . . with a little dozing into a level cut . . .

. . . between banks of earth five feet high.

er driver knows—on hard ground, you won't turn just by disengaging one track clutch. The free track coasts along, and although the tractor may slew a bit toward it, it won't swing around.

But if you brake hard, the driven track kicks its side around fast. Brake gently, and you turn more slowly, but most braked turns are made in a series of twitches rather than as a smooth swing.

***Going uphill,*** I found, you don't need the brake to turn. Just disengage one track and you turn toward that one. Go downhill, though, and your steering clutches work backwards. The free track, no longer held back by engine braking, coasts and over-runs the other, so you turn toward the driven track. It's just one of the things a tractor driver can never afford to forget.

"Try some dozing," suggested Bill. I headed for a small bank and lowered the dozer blade by nudging one of the hoist levers at my right shoulder. The blade bit in and earth boiled up ahead of it, with no perceptible slackening of our forward motion.

But this time when I disengaged a steering clutch the D8 promptly swung toward the free tread. (A heavy load acts like an upgrade, turns you without braking.) I went back to full drive on both tracks. Peering down, I was amazed to see a huge mass of earth being shoved ahead of the blade. The engine hadn't seemed to notice it.

A bit farther on, I stopped, then pushed the reverse lever forward—to go back. (This illogical arrangement, a hangover from early tractors, is too well embedded in practice to change now.) Throttle opened again, I yanked in the clutch lever, and the D8 obediently trundled backwards exactly as fast as it had been moving forward. Steering was the same too; it backed toward the braked tread.

Going forward again, as we crested a small rise, I translated Bill's hurried gesture in the nick of time—and raised the dozer blade. Nosing down the other side of the rise, the blade skimmed the earth. If it hadn't been raised, it would have jammed hard into the ground as the front end dipped—a toe-stubbing action rough on tractor and riders.

***Dozer blades are tough,*** of course, made of stuff akin to armor plate. Construction Seabees in World War II

stormed many a machine-gun nest with blades high to ward off bullets—then dropped them to literally bury the enemy alive. The new D8's blade weighs 8,200 pounds, is almost 13 feet wide, and with its cable control costs as much as a fancy convertible.

The new Cat has a decelerator pedal; kick it and the throttle cuts out briefly, slowing you momentarily for maneuvering or approaching the rear of a scraper to push-load. Then it automatically comes back to hand-throttle setting.

The engine rating of the D8 is different from that of auto engines. Normal Detroit practice is to strip an engine of its generator, fan, air cleaner and other power-robbing accessories before it goes on the dynamometer. Caterpillar's go on test with everything they're fitted with.

***The D8's new diesel*** develops its 225-horsepower rating at 1,200 r.p.m. (To develop the maximum power of your car engine, you'd have to rev it up to around 4,000 r.p.m. or drive at the wild edge of your speedometer dial.) The diesel puts out 1,150 pounds-feet of torque between 800 and 900 r.p.m.—roughly three times that of the biggest passenger-car engines. Part of this muscle is inherent in the diesel principle; torque comes up faster than in a gas engine. Part is in the long-stroke design (bore is 5¾", stroke 8"). But a big share of the torque rise is due to the turbocharger, used in D8s for the first time.

This consists of a turbine driven by the exhaust gases and direct-coupled to an impeller that shoves air into the intake manifold under pressure. It delivers more air than the pistons could take in by themselves; more fuel can be burned and so more power developed than in an uncharged engine of the same displacement.

***When the engine is heavily loaded,*** what happens? The governor admits more fuel to maintain engine revs at 1,200 r.p.m. Extra fuel generates a heavier exhaust, which pushes the turbocharger harder, feeding in still more air to burn with the added fuel. Engine speed may drop, but torque rises—as much as 20 percent, Cat engineers say.

Outwardly similar to other Cat engines, the new one is beefed up for its new power. The crankshaft is shot-peened (this compacts surface grain, boosting

[*Continued on page 244*]

# Brain Busters

## *The Case of the Becalmed Boatman*

A WEEK-END sailor in a borrowed sailboat found himself in the middle of a river when the wind died. He was disturbed as night came on, for being a stranger he could not have found the dock in the dark. He also remembered being told that evening calms often lasted for hours.

There were no oars aboard, but suddenly he spotted an empty rowboat about a hundred yards dead ahead, with oars in it. If he could reach this, he could tow the sailboat to the landing. But both boats were drifting downriver at the same speed, so the distance between them remained the same.

Nevertheless he thought of a way to reach the rowboat, and some 15 minutes later was pulling for shore. How did he sail without wind?

ANSWER: In a dead calm, there is no wind relative to the ground. But the sailboat's drift with the current created a slight breeze relative to the sail. The situation was the same as if the boat had been on a lake and there had been a weak breeze blowing from the direction of a stationary rowboat.

The boatman simply used his sail to tack against this relative wind, approaching the rowboat on a zigzag course until he reached it.

*Adapted from* Puzzle-Math *(Viking Press). Copyright, 1958, by George Gamow and Marvin Stern*

# BABIES TO

## THE OUTLOOK FOR

*With world population "exploding" fastest where the age-old problems of infertility, sex deter-*

QUEEN Soraya, divorced for her failure to produce an heir to the Iranian throne, was only the latest in a long series of women who have suffered because they didn't have babies, or had a girl instead of a boy.

Rather, she isn't the latest at all: There've been plenty more since, even if they didn't get in the papers.

Truly, babies can cause no end of trouble—by arriving or not arriving contrary to their parents' wishes, or by being the opposite sex from what their parents would have preferred. Divorce is the least of the misfortunes that can result. All through history there have been suicides, beheadings, wars started, dynasties overthrown, and countless other consequences.

The prospects look bright, nevertheless, that in that wonderful world of tomorrow these difficulties will be forgotten. Before long an engaged couple may be able to sit down and plan exactly the family they want. Such "family control," as we might call it, has three parts. First there's treatment of infertility or sterility, so that the couple will be able to have babies when they want them. Second, there's control of sex, to be able to arrange for the new arrival to be a boy or a girl. And finally there's birth control, or contraception, so the couple won't have a baby when they don't want one.

Here's how the current situation can be summed up:

 **No. 6 in a series of articles exploring the new frontiers of science**

# ORDER: POPULATION CONTROL

*food is scarcest, genetic research is focusing on mination and birth control* BY GEORGE R. PRICE

• In treating infertility, there's slow but steady progress. The problem is the toughest of the three.

• Control of sex, after years of pseudoscientific experimentation with little true knowledge, now suddenly looks brighter. New scientific evidence suggests that it will be possible.

• In birth control, there has been much scientific work in recent years. Results: one dramatic "breakthrough" and others in the offing.

Let's take a closer look:

***Infertility.*** About one out of 10 couples is troubled by low fertility or sterility. The husband is the cause of the difficulty in about a third of the cases. With good treatment perhaps 30 percent of the couples that ask medical help will have a baby on the way within a year. Without any treatment, about the same percent will have a baby eventually. (Statistics on infertility aren't very complete, so these figures are estimates.)

In men the trouble's almost always in the sperm cells—too few or not enough vitality, or both. Sometimes it seems to help to build up the husband's health and give small doses of hormones. In other cases, especially when the sperm count is low but their quality is good, artificial insemination is successful. At best, cure rates are very low.

In women there are more things that may go wrong, but also

## Was History Unfair to These Fair Ladies?

*History abounds with cases where the Queen was blamed for failure to produce an heir to the throne—unjustly in the light of modern genetics. Often she suffered. . . . Often the consequences were far-reaching for generations to follow.*

*Among the unlucky ladies were:*

**Eleanor of Aquitaine.** Her two daughters by Louis VII of France upset the course of history. Fearing no male heir, Louis had the marriage annulled—only to see Eleanor marry Henry of Anjou who became England's king in 1154. Resultant territorial disputes reddened French and English battlefields for the next 400 years.

**Catherine of Aragon.** As wife to Henry VIII, she produced numbers of children who inconveniently died at birth, or in the one surviving case was female. Uncertainty abroad and unrest at home made a male heir vital . . . and led Henry to a divorce that not only severed his ties to Catherine, but England's to the Church at Rome.

**Napoleon's Josephine.** She was the victim of nagging in-laws, a vain husband . . . and an inability to bear children for Napoleon. When the dictator's power lust made him Emperor, pressure for a male heir mounted. The marriage was annulled, and Josephine, "weeping constantly and pitiful to behold," was forced to retire.

**Princess Fawzia.** The beautiful sister of Egypt's ex-king Farouk wed the Shah of Iran in 1939 . . . uniting two powerful Moslem states. But the faith forbids women the right to succeed. Nine years and two daughters later the Shah divorced her—on the very day Farouk divorced his wife Farida—for the same reason: no male heir.

more success with treatment. Here are some of the reproductive ills that women are subject to:

- Failure to ovulate. Normally once each menstrual cycle one of the two ovaries releases an egg (ovum). If this process fails, a woman cannot become pregnant. Some cases are helped by hormones, X-ray, or surgery.
- Trouble with the cervix: The sperm can't get through into the uterus. Treatments: surgery to remove growths that block passage of the sperm, antibiotics to clear up infection, or hormone therapy to make the mucous secretions of the cervix more favorable for the sperm.
- Trouble with the Fallopian tubes, which lead from each ovary into the uterus. Normally fertilization takes place in the tubes. If they are blocked, a woman will be sterile. Blocked tubes are opened by surgery or by forcing gas through them. Other tube defects are sometimes helped by hormone therapy.

***Psychological factors*** like worry and tension can also cause sterility. Frequently a couple will visit a doctor after two or three years with no children, and the doctor will run tests over a space of a few weeks and find nothing wrong. But before he's even finished his tests, the wife is pregnant!

What may have happened was that the wife started worrying when she didn't get pregnant right away, and in some way this made her temporarily sterile. Then she went to see the specialist, and he made test after test. Impressed, her worries let up a little. The next thing she knew she was pregnant.

What about future possibilities?

Unfortunately there's no hope of finding a "miracle drug" to solve all infertility problems at once. The difficulty is that conception is exceedingly complex, with many different steps that must work together perfectly. It's like a chain with many links; if a single one is broken, the couple will be sterile. Doctors can hope only to learn how to repair more and more of the different links.

Hopes are high, nevertheless, because of the way knowledge about life processes is swiftly growing.

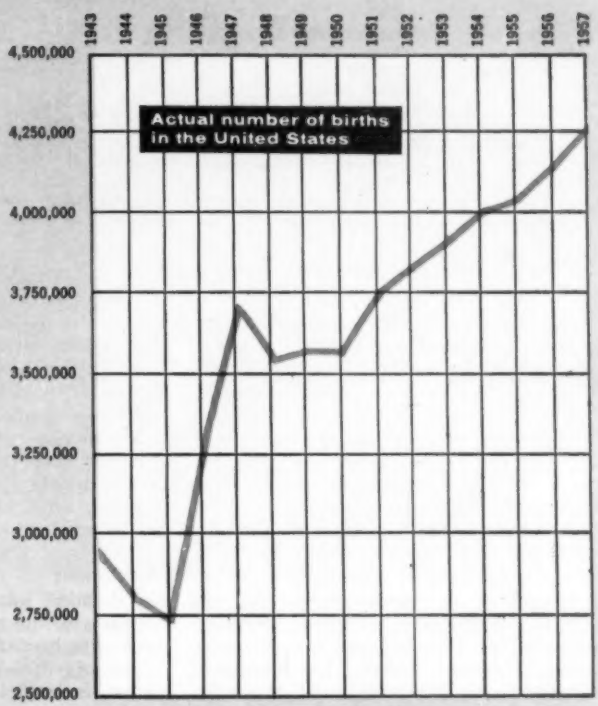
Here are three areas of research effort that look especially promising right now:

- Studies of the mechanism of sperm production. Perhaps, for example, the

## What's Happening to U. S. Population

Today's figure of 42 million American families may shoot up to 55 million by 1975 – with more kids per family. Here are some of the factors behind the expected increase:

- Population experts point to a super-abundance of little ones that's not just the result of high marriage and birth rates after World War II. Today's women of child-bearing age average 22 percent more children than those of 1950.
- Women marry earlier—at around 20.
- Opinion polls show most people think three children "ideal." Only one out of five thinks two is enough.
- Medical advances: More couples will be able to achieve the "ideal" family.
- More family planning: It will cut the number of extra-large families, but also reduce the number of families in the none-or-one-child group.




*Source: Public Health Service, Dept. of Health, Education & Welfare*

clue to the male-sterility problem will be found through discovery of a new pituitary hormone that stimulates production of sperm.

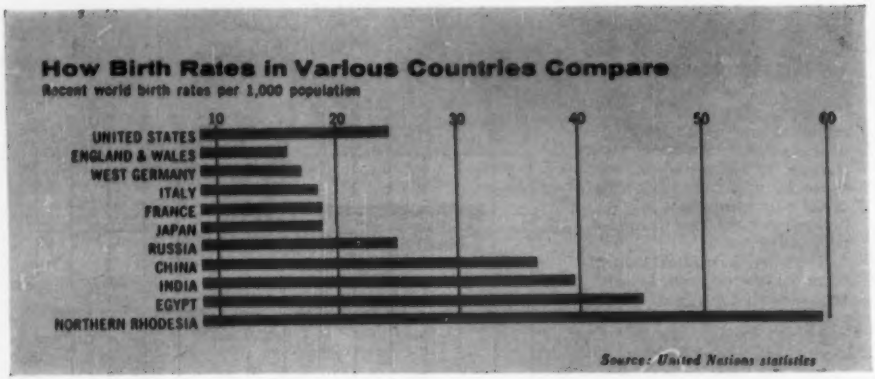
- Study of hormones influencing egg production and ovulation. At least a half-dozen different hormones from the ovaries, the pituitary, and the adrenals are involved here.
- Study of the fertilization process. This may lead, for example, to more effective techniques for artificial insemination, making low-vitality sperm usable.

Researchers working on sterility agree that 10 or 15 years from now there will be very much clearer understanding of fundamental reproductive processes. And they also agree that once they have this basic knowledge, prospects will be excellent for finding new and far better treatments for sterility. So there's a good chance that 10 years from now it may be possible to enable 50 percent of infertile couples to have a baby within a year, and 20 years from now the cure rate may be as high as 75 percent.

***Control of sex.*** Now assume the couple are able to have children. The next question is: Will it someday be possible to "order" a boy or girl at will?

An Egyptian papyrus more than 4,000 years old shows that parents were trying to do this that long ago. But important scientific work didn't start until the 1920s, and the first really encouraging results came in the 1930s, when a Russian scientist, Dr. Vera N. Shreder, claimed success in rabbits.

What she did was take a dilute solution of rabbit semen and pass an electric




current through it under carefully controlled conditions. Roughly half the sperm were transported tail first toward the positive electrode, half toward the negative. She found that sperm from around the positive electrode introduced into a female rabbit produced mainly females. Sperm from around the negative electrode produced mainly males.

The fundamental fact here is that sex is determined—both in rabbits and humans—by the kind of sperm that fertilizes an egg. Half the sperm carry the so-called X chromosomes, and these produce females. The other half carry Y chromosomes and produce males. This difference in chromosomes produces a difference in electric charge on the surface of the sperm, so that they can be made to migrate in opposite directions in an electric field. In short, it's the father that determines whether it's a boy or a girl.

Unfortunately, other scientists who tried to repeat Shreder's work usually couldn't. Either her experiments were faulty, or she hadn't published enough details about what she did. But finally, roughly two years ago, Dr. Manuel J. Gordon, a zoologist now at Michigan State University, succeeded. He performed a careful experiment, evaluating his results by statistical tests, and found that sperm near the positive electrode gave 71 percent female rabbits, those near the negative electrode, 64 percent males.

***Control with humans.*** Last October, newspapers reported something still more striking. An English biochemist, Dr. Sherry Lewin, had used this method successfully with human beings. However, Dr. Lewin has not yet published details of what he did, so scientists reserve judgment about it. But Dr. Gordon's results are definite, and there's no theoretical reason why the method can't be made to work with humans.

The big drawback for human use, of course, is artificial insemination. Sterile couples may want a baby so very much that they're glad to try artificial insemination, but for use in sex determination, a couple would have to be awfully set on wanting a boy or girl.

What about the possibility of some chemical placed in the vagina to kill one type of sperm or give another type greater motility? Back in 1940 a New York newspaper sponsored experiments to show that an acid douche before sex relations tends to produce girls, alkaline for boys. The method worked excellently—

*[Continued on page 246]*

**One square foot of land for each human being?**

*Dr. Harrison Brown of the California Institute of Technology calls the skyrocketing population rise "the most urgent and most critical problem confronting the world. . . . Science cannot provide the means for supporting a population which continues to grow at the rate of 18 percent per decade . . . in 730 years [at this rate] human beings will be so tightly packed that each of us will be able to own but one square foot of land."*

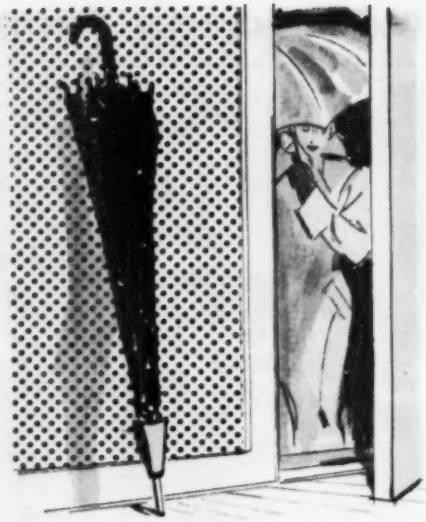
# New Ideas from the Inventors

**1 Movie Seats Roll to the Aisle.** Popcorn shoppers and late arrivers might shuttle in or out in these recently patented theater seats without disturbing other patrons. A control on each castered chair would operate a between-rows chain drive. Master switches in the aisles would indicate—and summon—vacant seats.

**2 Reversible Tie Has Double Life.** The wide end of this necktie would be finished on both faces—but with different patterns—to give you twice as many changes with half as many ties. A clip hidden under the collar would let you turn either face out without wrinkling.

**3 Radio Detects Atomic Rays.** Uranium prospectors and air-raid wardens could have music on the job with a portable radio that doubles as a radiation detector. To combine the functions at low cost, this inventor would use radiation-sensitive transistors in the radio circuits.

*Please turn the page for more new ideas*



**4 Bent Broom Sweeps Clean.** You wouldn't have to stoop or stretch to sweep under benches, counters, and the like if your push broom had an angled handle. The bent broom would also clean better and faster on low-down jobs because brush-head angle remains constant.

**5 Umbrella Foot Catches Drips.** You can't shake a soaked umbrella completely dry, but the drops that cling to the folded fabric needn't wet the floor of your entryway. Slipped over the stem of an umbrella, this funnel-shaped plastic cup would catch most of the drips.

**6 Scale Keeps Coffee Constant.** You could count on perfect coffee every time if you measured out the fixings on this scale. You'd first set it for the strength you like and compensate for the weight of your coffee-pot sections. Then, for any quantity, it would balance when water and coffee were proportioned.

**7 Shower Curtain Rolls Up.** This disappearing curtain might turn an ordinary bathtub into a modern, splash-free shower stall. A spring roller would wind the curtain inside a tubular housing while a squeegee on the lip of the housing wiped off excess water.

**8 Bumper Slides Absorb Impact.** Head-on collisions might cause fewer and less serious injuries if bumpers soaked up more of the crash force. These telescoping bumpers would be mounted with slide bolts and a series of tapered shear pins, so that impact would be partly spent overcoming resistance to the pins.

**9 House Current Starts Cold Car.** Feeding rectified house current at reduced voltage directly to the ignition circuit might start a car faster and conserve a battery made sluggish by very low temperatures. This plug-in unit could also be used as a battery charger, or it could be switched off for normal battery starting.

**The following patents** *have been issued on these inventions: 1. Patent No. 2,836,127 to E. W. Hagadorn, Solvay, N. Y.; 2. No. 2,834,967 to S. I. Taksa, Pittsburgh; 3. No. 2,839,678 to G. H. De Witz, Los Angeles; 4. No. 2,753,579 to T. C. Kussmann, Galesburg, Ill.; 5. No. 2,753,880 to Z. Garcia, NYC; 6. No. 2,635,724 to C. B. Eacrett, Sherman Oaks, Cal.; 7. No. 2,840,827 to E. Calvano, Los Angeles; 8. No. 2,837,176 to I. Dropkin, Brooklyn; 9. No. 2,821,563 to G. L. Roberts and E. C. Petersen, Anchorage, Alaska.*

*Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D.C., at 25 cents each. To write to an inventor, if the address given above is insufficient, you may address him (by name and patent number) in care of the Commissioner of Patents.*

# Should You Buy a Water Softener?

***Here are the facts to help you decide whether you need one***

**By Paul Corey**

UNLESS your faucets are hooked to a cloud, the water you're getting isn't as good as it might be. Flowing underground to your tap, water picks up two minerals—calcium bicarbonate and magnesium bicarbonate. These make your water hard.

But hardness is only one water problem. People living in 85 percent of the U. S. have some kind of problem with water that is perfectly safe to drink, yet is troublesome—even downright unpleasant—to use. Chances are, you may, too.

What are the possible troubles? Here are some of them:

- Hard water, besides leaving scum on laundry and around the bathtub, can actually make the food you eat hard and tasteless, and turn the luster of your wife's or best girl's hair into a sheenless shock of straw.
- Iron-bearing water is not hard, but can turn a rusty color that stains fabrics and porcelain sinks.
- Acid water can eat up your pipes.

• Sulfurous water can smell and taste like rotten eggs.

• Turbid water can look as murky and repellent as if it came from a swamp.

All these can be jobs for a water softener. In fact, today's units do so much more than merely soften water that their makers prefer to call them water "conditioners." Whether you'll need or want one depends on your particular problems and how serious they are. For instance:

***How hard is "hard"?*** Hardness depends on how much calcium bicarbonate or magnesium bicarbonate is present in the water when it reaches your tap. This is measured in gpg (grains per gallon) or in ppm (parts per million). The common five-grain aspirin dissolved in a gallon of water thus represents five gpg. One gpg equals 17.1 parts per million, or ppm.

If your water is ½-grain hard, you won't notice it. Soap can take care of that much hardness. It's the way soap and hardness minerals get together that's the tip-off to your problem.

The two minerals, hitchhiking with your water, gobble up soap until they can hold no more. Then, forming curds and scum, they stick to anything they can find: bathtub, dishes, fabric, skin, hair. You have to add more soap to do any cleaning.

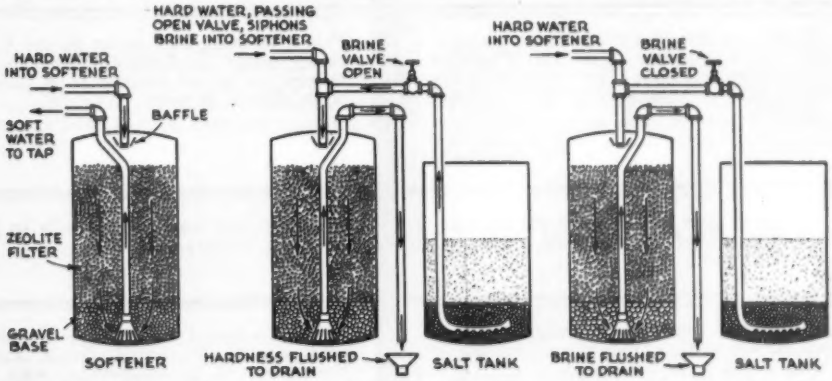
When water is heated, even without soap, the minerals become a fine deposit of calcium or magnesium salts. In cooking, they harden beans and peas, and leave a gray coating on beets. In hot rinse water, they turn into ghosts on dishes and glassware, grayness on clothes and fabrics, dullness on hair. They will build up a scale in your teakettle, hot-water pipes and water-heater tank.

***One simple cure.*** Water that is three grains hard, or less, can raise havoc with

**Consumer News**

### *How a mechanical water softener works*

SOFTENERS vary in looks and price, but work alike. Drawings show basic principles, but not actual plumbing: 1. softening—filtering out minerals; 2. regeneration—renewing filter with salt; 3. rinsing—removing salt. A fourth cycle occasionally backwashes the filter to settle it and eliminate "channels."




**SOFTENING:** Hard water flows through bed of zeolite grains, exchanging its calcium and magnesium ions for sodium ions. This "softens" the water, which comes up from the bottom through a return pipe and into the house water line.

**REGENERATING:** Salt water is drawn into an exhausted zeolite bed. It picks up the accumulated calcium and magnesium ions and puts back sodium ions. This "hardness" brine then goes up the return pipe and down the drain.

**RINSING:** To get rid of the salt, the hard-water flow is opened, and its return directed to the drain outlet. In about 30 minutes the unit is ready for softening again. Valves, automatic or manual, control the various cycles.

your wife's laundry, but luckily causes no cooking problems or trouble with scale deposit in pipes. The small amount of scale that does form will, in fact, help protect the metal pipes from corrosion. It takes 10-grain hard water several years to build up a $\frac{1}{16}$" layer of scale inside your plumbing.

For washing alone, your wife has a way out. Packaged softeners sold at groceries —borax, complex phosphates or plain old washing soda—will prepare the water so that only a normal amount of soap is needed to get clothes and dishes clean.

Even better are synthetic detergents—called syndets—which keep hard-water minerals from forming curds and scum as they do with soap. You can get syndets in several different forms to meet the different jobs of bathing and laundering.

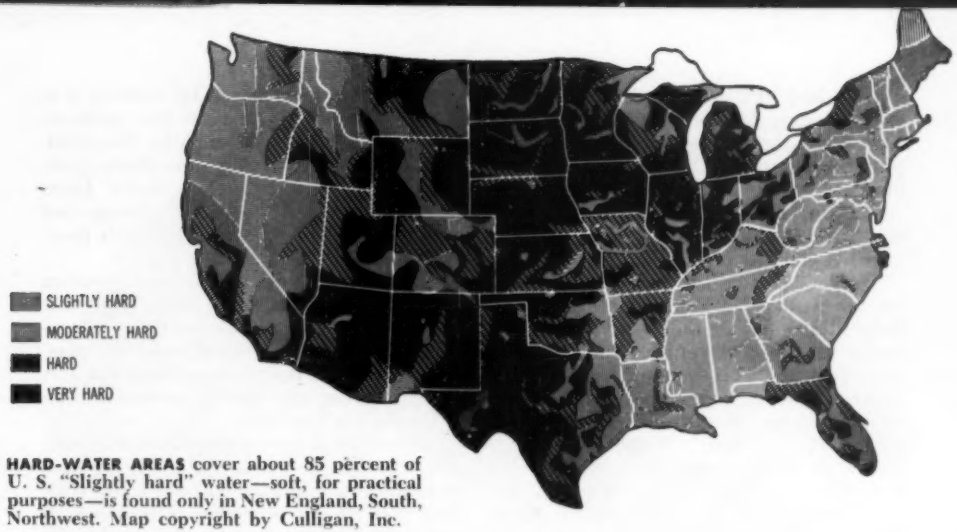
Remember, though: Both packaged softeners and detergents are only of use in creating suds. They're no help in providing clear, soft water for rinsing or for cooking. And they're no help at all in protecting your plumbing from caking if your water is really hard. For this, you may want to consider a mechanical water softener.

***Other water problems.*** Besides the hardness-making minerals, water may contain iron and/or manganese. It may be acid or alkaline. It may contain hydrogen sulfide, which makes it smell like rotten eggs. It may have a murky look.

Water from a well usually contains iron and manganese. The water may come out of the tap crystal clear. But let it set

## Five Common Water Problems

| | PROBLEM | WHERE FOUND |
|---|---|---|
| HARDNESS | Minute quantities of dissolved calcium and magnesium are picked up by water as it passes through the soil and rocks on its way to the water supply. | In 85% of the U. S. and Canada. Only portions of the Pacific Northwest, New England, Eastern Seaboard and Southeast rate as soft-water zones. |
| IRON AND MANGANESE | These are picked up by water passing through rock strata. Some iron is carried in solution, but some is precipitated by the air – oxygen – and carried as suspended particles. | Found in most well water in the U. S., rarely found in surface-water supplies. Manganese is less common than iron but more difficult to treat. |
| HYDROGEN SULFIDE | Gas often gets into water from sulphur-laden layers of rock through which the water passes. | Occurs in well water, principally in Midwest and Southeast. |
| OVER-ACIDITY | During lush, wet seasons, water may pick up carbon dioxide from plants, making it acid. A *p*H below 7.0 is acid. | In regions devoid of limestone—New England, Eastern Seaboard, South, Pacific Northwest. It is coincidental with low hardness. |
| TURBIDITY | Silt, sand and mud get into stream, reservoir, shallow-well water after heavy rains. Deeper wells can be affected by particles leached from soft rock. | Any place, but it is a serious problem in such semi-arid areas as Missouri Valley, Red River Valley of the Dakotas, and Rio Grande region. |




**HARD-WATER AREAS** cover about 85 percent of U. S. "Slightly hard" water—soft, for practical purposes—is found only in New England, South, Northwest. Map copyright by Culligan, Inc.

## In U.S. Households

| THE EFFECTS | THE CURE |
|---|---|
| Hardness forms curds with soap and wastes it for washing, bathing and shampooing. Hardness gives laundry a gray look, cuts fabric life. It forms scale in water heaters and hot-water pipes, increasing repairs and wasting fuel. | Chemical softeners and synthetic detergents will take care of many hard-water problems. Mechanical softeners—cation-exchange type—will supply soft water from faucets and eliminate scale formation. Cation-exchange softeners are reactivated with a salt solution. |
| Usually iron-bearing water comes out clear but turns rusty after standing. Iron and manganese stain fabrics and porcelains reddish-brown to black. Suspended iron particles foul up softener minerals, encourage corrosion. | Regular cation-exchange softeners will remove small amounts of iron and manganese. Larger amounts call for a special iron-manganese removal unit. This also works on the cation-exchange principle but must be reactivated with a potassium permanganate solution. |
| Water tastes and smells like rotten eggs. Tarnishes silver, spoils taste of food and beverages, speeds corrosion. | A basic water softener will remove small amounts, but larger amounts require a specially treated filter bed. |
| Corrodes plumbing. Leaves stain on porcelain and clothing—yellow from iron, bluish green from copper. | Neutralizer is needed. This is a basic softener tank with a treatment bed of limestone through which the water passes. |
| Gives water a murky look. Leaves a deposit on dishes and laundry. Can foul up a water softener by coating over the zeolite particles. | In amounts over 15 ppm a basic softener tank with a sand filter bed is used to trap the silt and clear the water. |

awhile and it'll turn reddish. That is oxygen going to work on the iron in it. Iron leaves a yellow or red stain on plumbing fixtures. Manganese leaves a brownish-black stain.

Carbon dioxide, which dissolves in water and forms carbonic acid, is the chief cause of water acidity.

To indicate acidity-alkalinity, chemists use the symbol *p*H. A *p*H of 7.0 is neutral. Below that number the water is acid and leaves yellow or greenish stains on porcelain, caused by corrosion in the pipes. Yellow is from iron pipes, green from copper. A figure above 7.0 is alkaline. Alkalinity is seldom a problem.

***How is your water?*** If you buy city water you can get the information you need by calling the waterworks office. They can tell you how hard the water is and whatever else about it that you wish to know. Some water companies soften water to one grain or less, but in most cases the hardness is not reduced below four grains.

To have completely soft water most suburbanites must go on from where municipal or public-utility treatment stopped. Those who supply their own water, from wells or springs, must start from the beginning.

Every mechanical-water-softener dealer will test your water free or send a sample to a laboratory for testing. So will either of the two big mail-order companies. Sometimes your state agricultural extension service will do it.

***What mechanical softeners can do.*** Water softeners can be made to do several tricks, depending on your needs. Their differences are important, however, so you have to know exactly what your problem is. Iron, for instance, in as little as three ppm can actually wreck a softener unless the softener is of the right type.

For removal of hardness minerals, the basic softener is a tank of gel zeolite, a white granular substance, through which water is passed before it reaches your tap. As the water filters through the zeolite, it gives up the calcium and magnesium ions (which make it hard) and exchanges them for harmless sodium ions in the zeolite. This process is called "ion exchange" or "cation exchange."

After a period of use the zeolite has all the calcium and magnesium ions it can hold and no more sodium ions to give out. It must then be renewed by soaking it in a salt brine. This releases the hardness and provides fresh sodium ions. The hardness load is flushed down the drain (note for outer-suburbanites: it won't harm your septic tank) and your softener bed will be back in business again. This process is called "regeneration."

The better grades of zeolite will soften up to 16,000 grains of hardness per cubic foot of material before requiring regeneration. An amber-colored, beadlike plastic, made from polystyrene resin but also called zeolite, will handle upward of 30,000 grains of hardness.

***Attacking the other problems.*** Gel zeolite will handle up to two ppm of iron or manganese, but if you have more than that you should consider getting a special unit. This works by ion exchange the same way the regular softener does. But to regenerate the bed you use a potassium permanganate broth instead of a salt brine.

The gel-type zeolite softener will remove small amounts of hydrogen sulfide. Specially treated zeolite will take out larger amounts. However, this type of softener will not eliminate the smell and taste of chlorine.

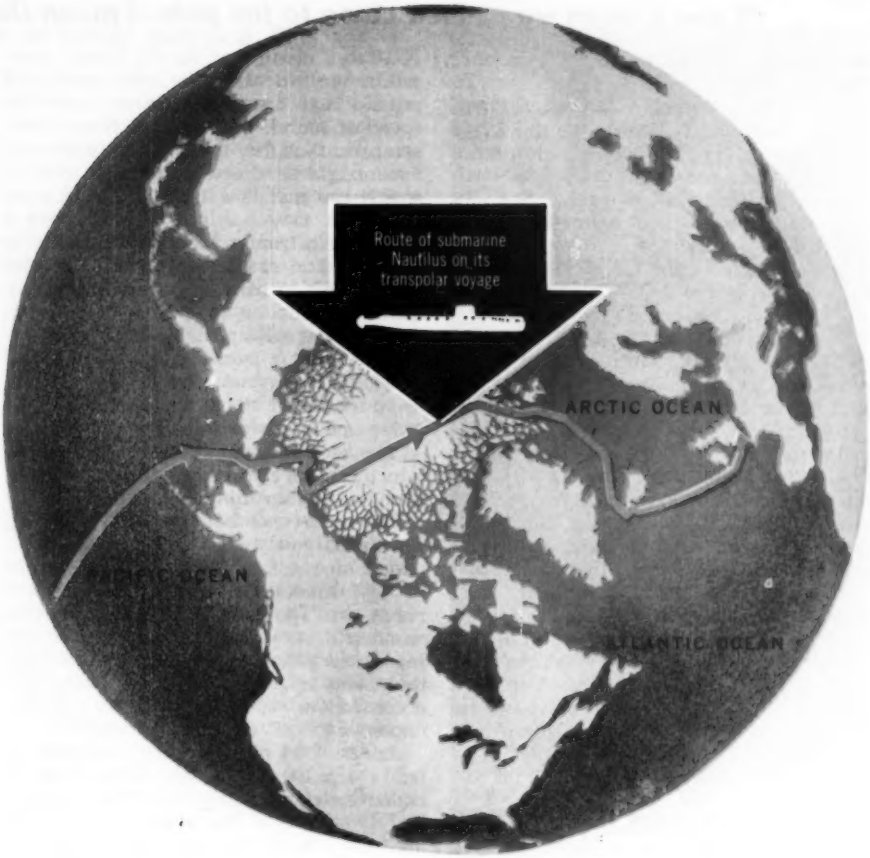
To correct acidity you get the same basic tank but, instead of zeolite in it, it will have calcium carbonate or limestone. When the water passes through this bed the *p*H is raised. But—and here's one hitch—the water is made a little harder.

***Three ways to get softeners.*** You can buy a mechanical softener for from $125 on up to $600, depending upon the size of the unit required and the degree of automation. Or you can rent one, or make a package deal that covers both rental and servicing.

The manual types make you do the regenerating. With the semi-automatic you determine the time to regenerate and flip a valve to start it. The fully automatic does all this on its own.

Renting a softener is a good plan if you rent your home since it's not the kind of appliance that can be moved easily from place to place. Rental cost: $3 to $5 a month.

Signing up for complete service offers the least bother. This includes installation of the unit and periodic replacement with a fresh one. The cost begins at about $3.50 a month. END




## Our amazing inertial-navigation system:

# How Nautilus Hit the Bull's-Eye at the Pole

**By Wesley S. Griswold**

AS THE great dark nuclear sub Nautilus slid forward through uncharted waters under the Arctic icecap last year, astoundingly true to plotted course on history's first submarine voyage over the top of the world, her crewmen gave a new name to their electromechanical pilot.

Officially, this transistor-brained robot was called the N6A all-inertial navigator. To the men who stared at it curiously when they passed its silent cubbyhole, it

## "I don't mean we passed close to the pole. I mean that

fast became known as "SFS"—Science Fiction Stuff.

The sub's amiable young skipper, Cmdr. William R. Anderson, shook his head in wonder at the N6A's performance after Nautilus had nosed under the North Pole. "It's fantastic," he said.

When Nautilus had swum into open water and sunlight once more, on the European side of the icecap, Cmdr. Anderson was flown to Washington to tell the world about his ship's unique journey. There he paid another tribute to the N6A's navigational accuracy. "I don't mean we passed close to the pole," he said. "I mean that we actually pierced it."

Strangely sure of itself, the N6A inertial navigator can tell precisely where it is without consulting sun, moon, stars, landmarks, radio waves, radar impulses or any outside guide whatever. It is oblivious to weather, immune to radio interference and unaffected by the earth's magnetism. This accomplishment, suitable for spaceships as well as submarines, is likely to revolutionize navigation.

***A curious history.*** The N6A was developed originally for the Air Force. A product of the Autonetics Division of North American Aviation, it is a direct descendant of an airborne inertial navigator, which showed off its talents for the first time in a C-47 in 1950.

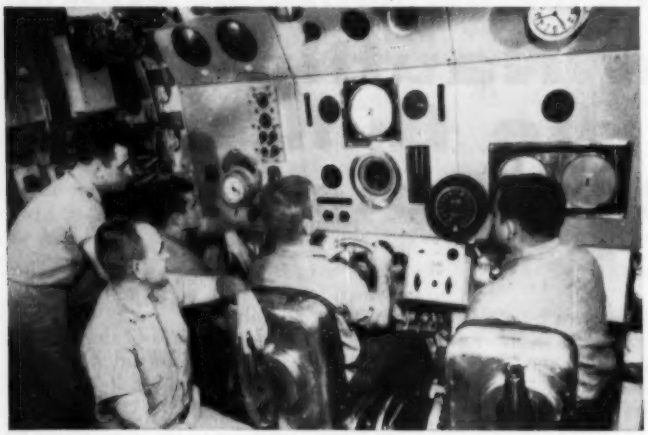
The N6, a refined offspring of the 1950 pioneer, lived at a breathless pace. It successfully guided both the supersonic X-10 test missile and the Air Force's ramjet-driven Navaho, an intercontinental missile that traveled at three times the speed of sound. When the Defense Dept. scrapped Navaho, the N6A, an improved version, got Air Force permission to go to sea. It was installed in the USS Compass Island, a cargo ship converted into a floating electronics laboratory. There, it performed so spectacularly well that the Navy, with transpolar ventures in mind, asked Autonetics to put inertial navigators aboard Nautilus and Skate.

***How does it work?*** Inside an inertial navigator are gyroscopes, accelerometers, servo motors, a clock, an electronic computer and a power source.

The clock keeps sidereal—star—time, which is more exact than sun time, though each day is four minutes longer.

The gyroscopes hold a platform steady for the extremely sensitive accelerometers, which measure the slightest acceleration in any direction of the vehicle they are riding in. The computer thinks for this wonderful movement-sensing system. It interprets the movements, measures and tots them up, then translates them into a continuous report on progress over the curved face of the turning world.

At the start of a trip, the computer is fed a length of punched paper tape—coded instructions that tell it the latitude and longitude of its point of departure and give it a complete fill-in on the planned course and desired destination.



**CALLING THE SIGNALS:** From its location one deck above, the Nautilus' inertial navigator transmits precise information to this three-position control stand—where it is put to immediate, practical use. Left-hand station is for steering; center one operates the stern planes; right-hand one works the bow planes.

## we actually pierced it"

The tape also tells the computer the curvature of the earth and its radius, the rate and direction of the earth's rotation, and the pressure of gravity at its surface.

Thus the journey begins with the computer knowing just where it is and where it is supposed to go, and with the accelerometers, steadied by the gyroscopes, primed to tell it what the vehicle is doing at every instant. Once the vehicle starts moving, the computer is able, too, to remember just where it has been, which is vital to all navigation.

***Why "inertial"?*** Because it depends basically on the way an inert mass behaves when it is forced to accelerate. (That includes slowing down, which is a negative acceleration.)

When you lay a package on the seat of your car, the first time you make a sharp turn, the package slides in the opposite direction. If there were a spring mechanism that would restrain the package and push it back until it caught up with the acceleration of the car, the force needed could be exactly measured. A law of physics says that the force required is directly proportional to the amount of acceleration. Multiply your car's average acceleration by the length of time it accelerates, and you'll find out how fast you are going. Multiply your average speed by the length of time you are in motion, and you'll find out how far you have gone.

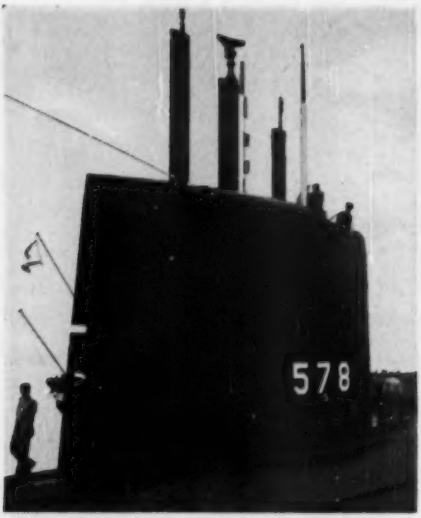
This is the basic behavior of an inertial navigator. The gyroscopically stabilized accelerometers, containing tiny weights at both ends, indicate the vehicle's direction of movement and measure accelerations. The computer translates their findings into distance traveled. In addition, it keeps a running record of the voyage, continuously checking the actual course against the instructions.

As installed on Nautilus and Skate, the N6A provided a continuous, visual report of the ship's position. Latitude, longitude, heading and true speed "over the bottom" (with the backward push of adverse currents neatly subtracted from the forward thrust of the vessel) were shown on mechanical counters. A stylus moving across a chart drew an up-to-the-instant picture of the sub's course.

***The remarkable computer.*** Smaller

**NO ROOM FOR ERROR:** Skate's inertial-navigation system gets a final check before the nuclear-powered sub's polar crossing. Digital computer is at top center. Below, with a piece of test equipment resting on it, is the semicircular housing of the navigator's stable platform.

**LIKE OFFICE FILE CARDS,** circuits in computer—brains of the system—can be pulled out easily for testing or replacement. Circuit wiring is etched on gold-skinned plastic panels.




**ANTENNAS SPROUT** from "sail" of Skate, shown at anchor in New London. One hoists the electronic sextant that took star sights through holes in Arctic ice, doubly proving N6A's accuracy.

than many home TV sets, the N6A's computer contains 1,000 transistors. Its circuits are etched from sheets of gold-skinned plastic. It is capable of solving in one second problems that would take a human expert nine hours.

Below the computer and attached to the deck is the N6A's so-called "stable platform," the complex of gyroscopes, accelerometers and servo motors that keeps track of the ship's movements and tells the computer what they are.

***The power pack.*** Against a bulkhead opposite the N6A's computer and stable platform stands the inertial navigator's special power supply, with barely room enough for a man to squeeze in between. It is mounted under an oddly tapered metal cover, whose shape is a reminder of the days when it rode in a guided missile. The inertial navigator's electrical source must be extremely steady to keep the gyroscopes spinning at precisely 12,000 revolutions a minute. Otherwise they would drift badly, and throw all calculations awry. An error of one degree in the axis of a gyro could lead the carrying vessel 60 nautical miles astray.

Inertial navigation has been called a super-sophisticated kind of dead reckoning. Dead reckoning is one of the oldest and simplest means of finding one's way over the surfaces of the globe—keeping track of one's speed, and plotting a course by compass and clock. But, as an Autonetics official has said, comparing conventional dead reckoning to inertial navigation is like comparing a Roman chariot to a new Cadillac.

***Adjusting the platform.*** In the N6A, two accelerometers lie fastened to the top of the platform, at right angles to each other. One lies in a north-south position, the other along the east-west axis.

Three gyroscopes, mounted perpendicular to one another under this platform, and in gimbals to keep them free of the frame of the submarine, hold the platform horizontal at all times. If they did not do so, the accelerometers would give false interpretations of the sub's movements.

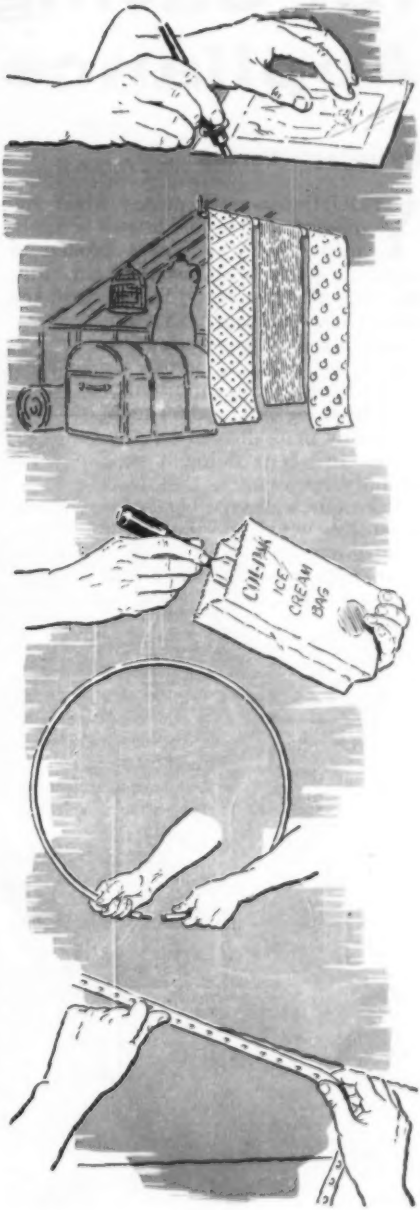
Naturally, the platform must tilt gradually as the ship moves over the surface of the curved earth, for otherwise it would not remain horizontal. The computer, having always in its electronic mind a precise knowledge of the ship's location, distance traveled, heading and rate of progress, knows when and how much the platform should be tilted, and commands gyro controllers to do the job.

The accelerometers sense and signal to the computer all accelerations of the vessel in any direction except straight up or down. Strictly vertical movements have no effect on a ship's geographical position, of course, and thus are ignored.

***Approaching the pole.*** Even with the best of conventional instruments, Nautilus and Skate would probably have lost their way in the depths of that icy, roofed-in sea. As they drew close to the North Pole, all points of the compass except north huddled together in confusion. A magnetic compass would have been in a whirl. The finest gyrocompass, which merely tells direction, not distance traveled, would also have been unreliable. No radio stations could be used to take a fix. Celestial navigation was a bare off-chance, depending on the unpredictable existence of holes in the icecap, through which Nautilus and Skate were prepared to thrust a hydraulic antenna with an electronic sextant on top. (Skate, outdoing Nautilus by crossing the Arctic Ocean in both directions, actually did

[*Continued on page 252*]

# 5 BUDGET SAVERS for Home Owners




**1 Preserving newspaper clippings,** identification cards, even Junior's first school drawing, costs a lot less if you do it yourself. Simply sandwich the paper between two sheets of plastic (old negatives are fine for back sheets) and heat-seal the edges with a wood-burning tool.

**2 After you hang wallpaper,** unroll the left-over paper in the attic or in a room used for storage. It will change color gradually, the same as the paper on the wall. Then if it is ever necessary to do a patching job, the "seasoned" paper will blend in with the wall.

**3 Beat dust and rust** with the foil bags some food stores furnish for carrying home packaged ice cream. They're ideal for shop storage. After a hand tool is oiled or a paintbrush is cleaned, drop it in a bag and twist a pipe cleaner or a rubber band around the top to seal it.

**4 Hula hoops for three**—or six—cost less if you make them yourself from 6′ lengths of ¾″ plastic water pipe. Just join the tubing by inserting 6″-long ¾″ wood dowels coated with plastic cement. Two brass nails driven through the hoop and dowel will secure the joint.

**5 Here's a builder's trick** to remember when you have to repair a cracked ceiling: Instead of patching, use the tape made for covering seams in plasterboard walls. Coat the crack with the tape-applying mix, lay on the tape and put another coat over it. When dry, fair the edges smoothly and paint the ceiling.

# My Secret for Saving Money on Appliance Repairs

**By Joseph Tartas**

YOU throw away money when you discard a household utensil or appliance because it has a broken or worn-out part. Most people know this. But they do it anyway, in the mistaken belief that repairmen have a monopoly on service information and spare parts.

**Home and Shop**

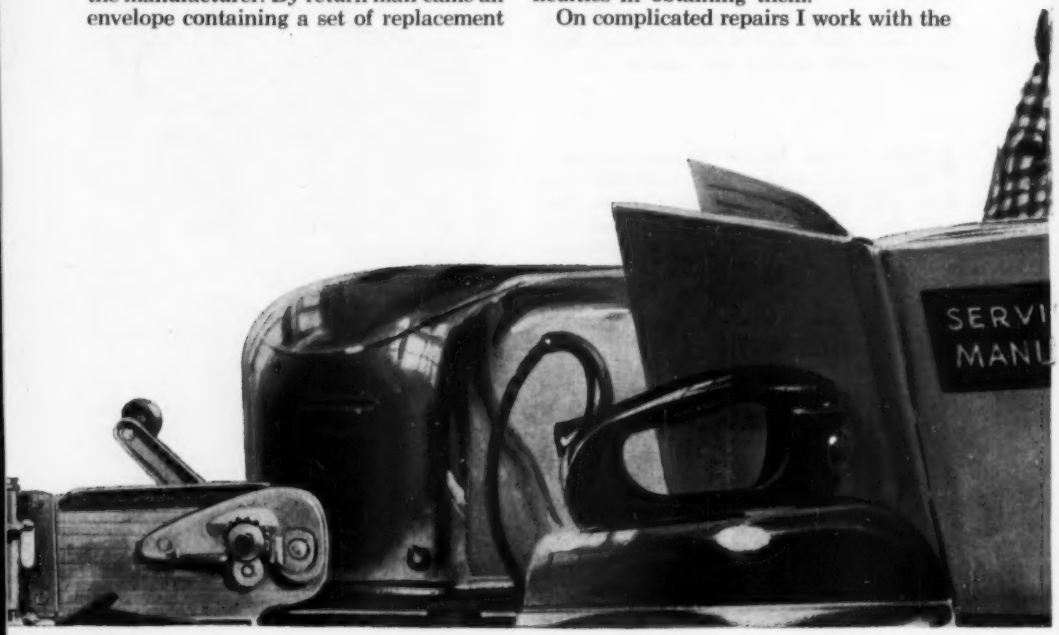
The truth is, you can usually get everything you need for such repairs by mail, direct from the maker. I've been doing it successfully for years.

Take our wall-type can opener. When the cutting wheel and the gear that drives it wore out from normal use, I queried the manufacturer. By return mail came an envelope containing a set of replacement parts, instructions for installing them and a bill for 50 cents. Ten minutes work restored what had been a $4 can opener to like-new condition.

Our pressure cooker gave out after several years—the cover gasket no longer sealed it tight. I sent a card to the manufacturer and got back two new gaskets, two tubes of special cement, a spare safety valve and complete instructions. The enclosed bill for $1 was gratefully paid. Saving: at least $10 on a 20-minute repair job.

A dozen or so burned, cracked or broken handles have been replaced by writing to pot, pan or kettle manufacturers. Cost was small and there were no difficulties in obtaining them.

On complicated repairs I work with the



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manufacturer's service manual at my elbow. In some cases there is a nominal charge for it. But this is well worth paying; on several occasions it has stopped me from tackling a job beyond my skills. The cost was repaid in grief avoided.

When our steam iron stopped steaming I found from reading the instruction manual that it needed a new pressure seal. The manual called this a "funnel closer" and the manufacturer sent me one for 50 cents. Replacement took a few seconds; the saving was about $16.

***Major appliance repairs*** are often simple too when you have a service manual. The effort is well worth while, since labor is the largest part of any repair bill.

I have been able to keep the washing machine in perfect working order for 10 years without once calling in a serviceman. When the machine was only a year old a major part wore out because the operating instructions had not been followed. A letter to the maker brought a service manual and a reply describing the cause of the trouble, the reason it had happened and the name of the part needing replacement. It also gave the name of my nearest parts distributor.

I telephoned the distributor and had the part next day by parcel post C.O.D. The cost of part and postage was $11. But I had saved $35 in labor charges, as I found out from a friend who had the same trouble fixed by a repairman.

Minor repairs over the next nine years added to these savings. The service manual not only told the cause of troubles, but gave explicit instructions on proper disassembly (an art in itself). I found the right replacement parts from pictures in the manual; installation was explained in the text.

An often-overlooked value of the service manual is the thorough explanation it gives of how the device works, mechanically and functionally. Maintenance or repair is much easier when you understand the function of each part. And in the rare cases where specific trouble-shooting information is missing, a little logic coupled with general knowledge gained from the manual helps you locate the difficulty.

***Service manuals are available*** for most household appliances and for all major equipment, like heating systems. They may not enable you to do major repairs (which are best handled by an expert with the right tools anyway), but they do help you avoid the more common minor repairs that still cost plenty for labor.

Here's how you can handle most of the upkeep yourself on household utensils and appliances. First get the correct name and address to write to for parts, manuals or service information. They are usually engraved on the appliance's nameplate. The instruction manual also carries a name and address, or you can ask a local dealer or distributor.

When you write to the manufacturer's service department, give this information:

- Model name or number.
- Serial number (this tells the year).
- Appliance equipment is used with, if part of a larger unit. Examples: motor, switch.
- Complete description of part needed, including dimensions if possible.

Ask whether the part you want is available and what its delivered price will be. Query too about a service manual or maintenance guide. Chances are the part and manual will be sent by return mail with a bill. Naturally you will want to play fair by sending payment promptly.

***If you're in a hurry,*** you can do one of two things. Ask the manufacturer to ship C.O.D. whatever parts he thinks are necessary from your description. Or look up the local distributor, dealer or repairman, in that order.

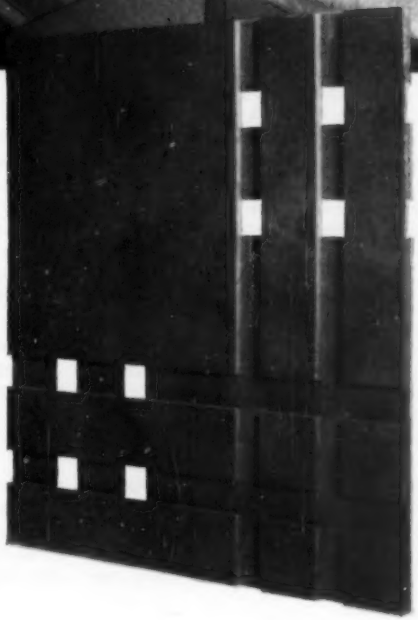
Either way, you will pay more for the faster service. From the manufacturer you may get more parts than are necessary to fix the appliance—these can be saved as spares. The local supplier will probably charge more for a part, but don't begrudge him that extra profit. He must spend time and money to get it.

Plan ahead when you buy a new appliance. It's a good idea to read the instruction book packed with the device and see if spare parts are mentioned. You may even be able to anticipate what parts will be apt to need replacement with normal wear. It's easier to obtain these, along with a service manual, while the appliance is still new. File everything away together where you can find it later.

Be sure to use your guarantees too, in case of trouble. Know what they cover, and for how long. Keep guarantee cards with the spare parts and manual. END

# How to Cut Decorative Patterns in Hardboard

**DADO CUTTER,** used in a radial saw as shown, or in a table saw, is set to cut slightly deeper than halfway through the hardboard. Crossing grooves on opposite sides create openings.



LATTICE-LIKE patterns —grooves interspersed with flashes of light—are easy to produce with a dado cutter. The design at the top of the page was made by grooving the panels diagonally. The conservative pattern at right resulted from grooves cut at right angles. Backed up with translucent plastic, the openwork takes on color. Don't cut opposing grooves on the same line; the panel will separate.

Assembled in a frame, the panels become an unusual folding screen or room divider. Singly, they make attractive cabinet doors.

# 12 RULES FOR Selling a House at the Top Price

**By John L. Springer**

THE typical U. S. family owns three houses in a lifetime. So it's probably in the books that sooner or later you'll offer yours for sale. And, as buying a home is the average man's biggest investment, selling one is probably the biggest sale he'll ever make. Handle the deal right and you'll wind up with hundreds—perhaps thousands—of extra dollars.

How should you go about making sure of those extra dollars? Here are 12 tips from real-estate brokers, mortgage men and other experts.

**1 Offer it at the right time.** In most sections, spring is the best season to put up a For Sale sign. The weather invites people out to look around. Also, families with children want to make a deal in time to move before the school year starts. Fall is the next best. Bad weather keeps prospective buyers home in winter; vacations take precedence in summer.

**2 Repair major defects.** Brokers agree that nothing depresses house values more than an unkempt exterior—missing shingles, neglected shrubs, a scrubby lawn. John C. Tysen, president of the nationwide real-estate firm of Previews, Inc., says that one coat of paint often increases the sale price of a modest home by $1,000; a tree strategically placed is worth $100; and every dollar spent on grass seed may bring back 10. A good exterior appearance, he says, can add 10 to 20 percent to the selling price.

On the other hand, keep interior decorating to a minimum. Mike Licht of Lane Realty, one of the largest brokerage firms around New York, says that most homeseekers prefer to do their own inside refurbishing. Sales actually have been lost by home owners who repainted interiors. Women prospects disliked the colors, and knew their husbands wouldn't stand for the cost of a new job on the just-completed one.

Authorities do agree that serious wall or ceiling cracks should be repaired, and offensively dirty walls repainted. In such cases, Beatrice West, color and design consultant, suggests neutral colors: whites, off-whites, grays and beiges.

**3 Keep the house furnished.** Builders of new houses spend thousands of dollars on rugs and furniture to give their models a lived-in look. Some say a furnished house is 10 times easier to sell than an unfurnished one. Furnishings make rooms look larger and give prospects confidence that their own pieces of furniture will fit in. Prospects viewing an older house that's been stripped may suspect that it's a lemon the owner has been unable to sell. They figure the seller is desperate, and an offer is apt to be low.

**4 Clear out attic and basement.** Brokers say that convenient storage space is a big sale attraction. A cluttering suggests that something's wrong with your storage areas. Most families dispose of their junk when they move, anyway. Do it before you offer your house.

**5 Deal with reputable brokers.** A competent broker knows market conditions and can accurately estimate how much your house will bring. He'll search out prospects, show them through your house and handle other details. His commission usually will equal five percent of the sale price.

You can give one broker an exclusive listing. This means that he alone has the right to sell the house for a specified period (usually three months). In return he'll advertise the house widely. Or, if you prefer, you can give your house to many brokers, paying the commission only to the one who actually makes the sale. Under this arrangement, you can also try to sell the house yourself; if you make the deal without a broker's help, you pay no commission.

Beware of fast-talking brokers who promise you a high price if you give them an exclusive listing. After they tie your hands, they may try to pressure you into taking the first offer, no matter how low. Before giving any broker an exclusive listing, check his references. Your local banker is a good source.

When you list with a broker, you're obliged to pay him a commission if he produces a customer who will pay the price you have set.

**6 Set a realistic price.** Most owners have inflated ideas of what their houses are worth. For about $25 you can get a qualified house appraiser to examine your property and give you a line on its current value. Your bank can recommend an appraiser. Wesley Bahr, vice president of the First Federal Savings and Loan Association of New York, says that most prospects for old houses hope to pay less than the asking price, so it's a good idea to quote a higher price than you really expect to get—but not too high, or it will discourage offers. He suggests that you give yourself bargaining leeway by asking up to 10 percent more than an appraiser

figures your house is worth. Beyond that you may price yourself out of the market.

**7 Be prepared for questions.** Pin down all the facts a buyer might want to know. Based on its own appraisal, your bank will tell you how big a new mortgage it will give a qualified buyer. You can usually get a better price if a prospect can take over your property with a small down payment. Other hard facts you should have down in black and white: annual taxes, heating costs, commutation details, schools and churches nearby.

**8 Advertise widely.** "You can't sell them if you don't see them" is an old sales adage. A prospect has the incentive to act swiftly if he sees others interested in your house and fears they may shoot in ahead of him. Having a lot of lookers at your house will also increase your confidence and make you a more enthusiastic salesman. Run ads in your local papers. Post a conspicuous sign on your lawn. Use word of mouth: Tell your neighbors, your clergyman, local merchants.

**9 Use the soft sell.** "Trying to high-pressure a prospect is one of the worst mistakes any house salesman can make," one prominent broker told me. "People buying a house want to make up their own minds and want to take plenty of time doing it. High pressure suggests that the salesman is trying to force them into acting before they are ready. This technique almost always backfires."

In showing prospects through, don't rush them. Don't monopolize the conversation; give them the opportunity to ask questions. Be cordial. After they inspect the house, invite them to sit down and relax with a cup of coffee.

Many professionals keep books or games handy to amuse children while their parents go through the house. "If you can't keep the kids quiet, they can wreck your chances," one veteran salesman advises. "Their parents will be too anxious to get the children out of the house to pay attention to what you're trying to show."

Encourage prospects to open doors and peep into closets; never give the impression you're trying to hide something.

**10 Compromise on price.** Any broker can tell you of home owners who tried to hold out for the last dollar—and wound up taking less than they could have got originally. Most homes sell within three to six months, and statistics show it's almost an even bet that you'll get your best offer the first month. If a buyer comes within a few hundred dollars of your expected price, you'd probably be wise to sell. If you hold out too long, you may become discouraged and let the house go to a low bidder just to get it off your hands.

**11 Keep a record of prospects.** List names, addresses and phone numbers. Few persons buy a home on first inspection. They want to see others and weigh all factors. If they show any interest, it may pay you to call them later, just to let them know that you will gladly show the house again any time. If a prospect asks questions you can't answer right off, get the facts and phone him.

Sometimes a sale falls through at the last minute. If that happens to you, a list of interested prospects means you won't have to start afresh. Real-estate brokers consider their lists of would-be buyers their most valuable sales getter.

**12 Hire an experienced lawyer.** Buying and selling real estate is loaded with legal booby traps. Your bank can recommend an experienced man who will prevent costly mistakes. Consult him before you put your house on the market. He will help you with any contract you sign with brokers, draw up the sales contract, and make sure that you will collect the deposit if a prospect decides to back out later.

Your lawyer also can tell you what things are considered part of your house and should be included in the sale price: screens, storm doors, range, etc. He can draw up the contract so the buyer must pay extra for such items as a refrigerator and blinds. He will see to it that the buyer foots the bill for closing costs (surveys, title insurance) and also that the purchaser reimburses you for items such as taxes and insurance that you have already paid. END

know-how file

*The fine points of*

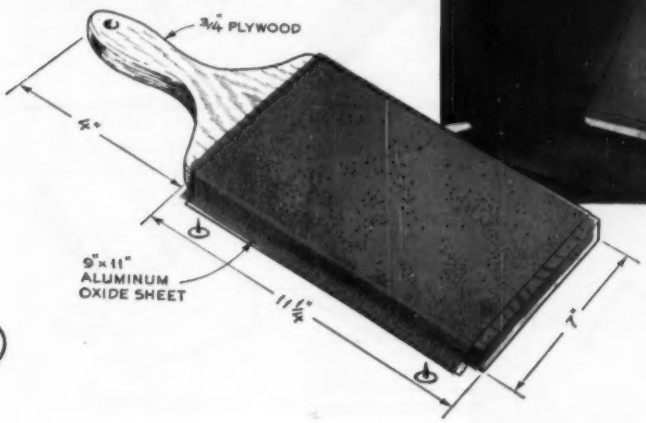
# Sharpening Household Tools and Knives

**A FLEXIBLE SANDING DISK** used in an electric drill quickly puts garden tools in shape. Not really a sharpener for cutting edges, the disk is best used for touching up large areas.

THE sharper you make a tool, the safer it is. Hard to believe maybe, but a dull knife, chisel or plane makes you press harder to cut with it, and bearing down hard encourages slipping.

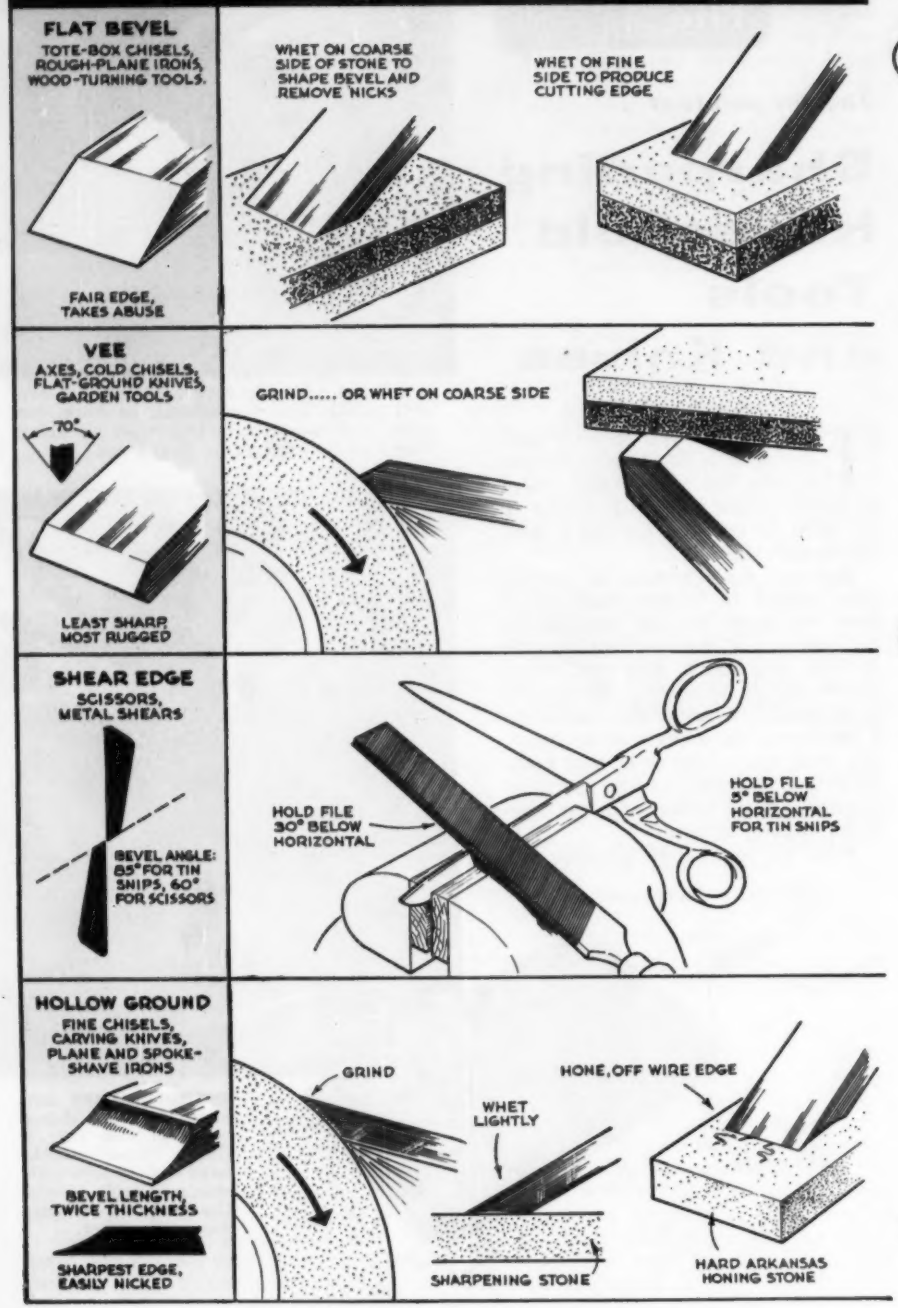
But that doesn't mean all cutting gear should be scalpel-sharp. How keen you make an edge depends on the type of tool, the work you do with it, and how much time and effort you're willing to expend. It takes 10 to 15 minutes to grind, whet and hone a chisel to a razor edge; many everyday tools don't have to be that keen. In fact, some tools—a bread knife, for example—work better with an edge that's slightly ragged.

***What do you need?*** Kitchen cut-



**KITCHEN CUTLERY** can be kept in top slicing condition with only a simple wood paddle faced on both sides with aluminum-oxide cloth. Use coarse on one side, fine on the other.

## Four familiar edges and how to sharpen them



lery can be kept keen with nothing more than a wood paddle faced with aluminum-oxide cloth, coarse on one side and fine on the other. Even this modest equipment is an improvement over reaching out the window and drawing a knife across a masonry sill.

Most general sharpening can be done by hand with only an oilstone, but the more equipment you have, the easier the job becomes. For sharpening knives, most five-and-dime stores carry a sharpener made of hardened-steel disks. You simply pull the knife through the disks to form a keen V edge. Electric sharpeners—grinding wheels set at a V angle—do a faster job when a knife is drawn between the wheels. A carving set usually includes a lance called a sharpening steel, for the turkey carver. It will sharpen your other knives as well.

A complete set of oilstones should include a two-sided stone made with one side coarse and the other side fine, a marble-like Hard Arkansas stone, and a fine slip stone with rounded edges for touching up gouges.

***The utility edge—a flat bevel.*** For most work around the home, you'll find a flat-beveled edge rugged and serviceable, and you don't need a grinding wheel to shape it. Because it's more durable, this edge is right for chisels used for cutting hinge gains or lock mortises, and for a plane kept in a tote box to free stuck doors or storm sash.

The easiest sharpening procedure:

- Whet the bevel on the coarse side of a flat oilstone to remove nicks.
- Whet the bevel on the fine side of the stone, rubbing the tool alternately on the bevel and on the flat side until it feels sharp. Test it occasionally on a piece of scrap wood. When the edge will make a clean cut *across* the grain, you can consider the tool sharp enough.

***Edges that need only grinding.*** Whetting is wasted on such tools as a hatchet or axe, a cold chisel, or a breadknife. And some tools such as drills and punches should *only* be ground lightly to put them in condition. The best edge can be easily put on these tools with a wheel or abrasive of medium to fine grit.

***Shearing edges.*** Unless you've developed a fine touch with a grinding wheel, filing is safest for scissors and tin snips. It's easy to remove too much metal when

## *Abrasive cloth makes power sharpening easy and safe*

**CEMENT ALUMINUM-OXIDE CLOTH** to a wood disk to make a power sharpener that will take all the abuse you can give it. Drive it with a lathe, table saw, sander or spare motor.

**DRUM SANDER** faced with fine abrasive cloth puts a highly polished edge on almost any cutting tool. The cast-aluminum drum shown can be bought at a jewelry-supply house.

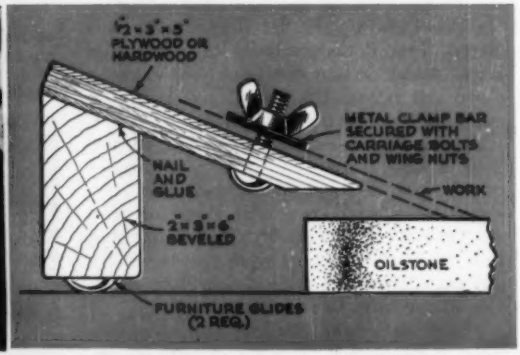
**BROAD-EDGED TOOLS** such as this draw knife are easily maintained with a small drum sander mounted in a flexible shaft. Though safe, the sander does throw sparks, so wear goggles.

## *Most sharpening jobs can be done by hand*

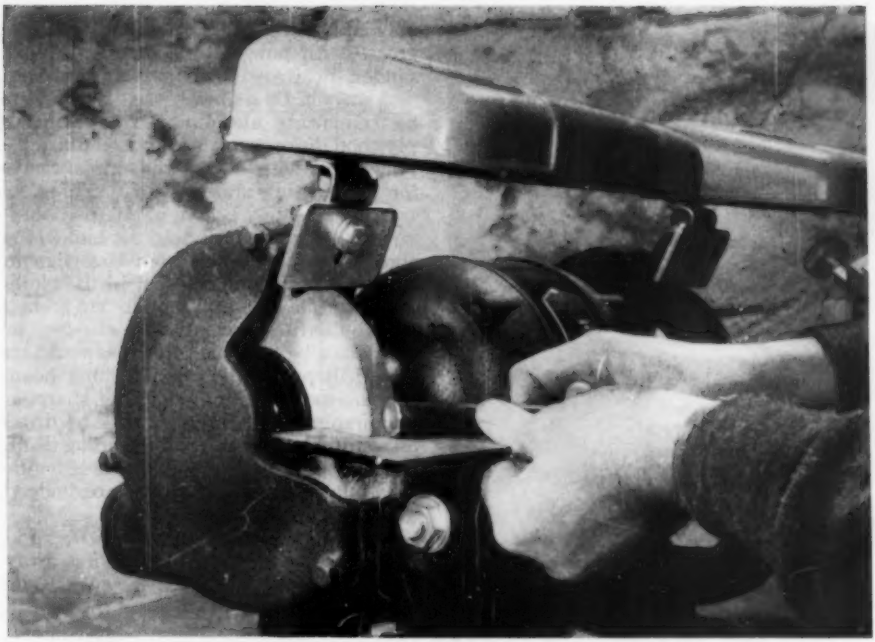
**SANDING BLOCK** does double duty as a sharpening tool, above. Clamp emery or aluminum-oxide cloth in it and use it as you would an oilstone on an axe or other broad-edged tool.

**A FILE IS THE THING** for shears, saw teeth and other tools made of tough steel drawn to relatively low hardness. Finish by draw-filing—sliding the file sideways along the edge.

**FOR THE FINAL POLISH** on any edge, you'll need a Hard Arkansas stone. Resembling marble, and so smooth you hardly think it's cutting, it makes a just-good edge into a razor-good edge.




**A SIMPLE JIG** will maintain the bevel angle and prevent rocking when honing chisels or plane irons on an oilstone. Extend tool from jig for best angle and clamp it. With the base resting on a flat surface, move blade over stone. Furniture glides help the base move easily.



***A bench grinder cuts fastest***

**BENCH GRINDER,** a necessity if you're a serious woodworker, is also a worthwhile investment. For safety, it should have equipment shown here—big flanges on the wheel arbor, a guard and end cover that surround the wheel 270 degrees, and spark shields of shatterproof glass.

grinding, and shearing tools generally are made of steel soft enough to be filed. A bevel of about 60 degrees is recommended for scissors. To form it, clamp one blade in a vise, bevel side up, and file across it, tilting the file upward at an angle about 30 degrees off horizontal. Repeat on the other blade. As a final touchup, you can whet the *flat inside surface* of each blade on the fine side of the oilstone. Tin snips have a bevel of about 85 degrees—almost square. Tilt the file slightly up (about five degrees) when filing their blades.

***The best edge—hollow ground.*** A barber's straight razor is ground so hollow it resembles the bow of a gracefully sheered ship. When a hollow-ground blade is honed, only the cutting edge and the back of the blade come into contact with the stone. Light whetting and honing will sharpen the edge and keep it that way over a long period of use before regrinding is needed to restore the hollow.

To produce a hollow-ground edge:

- Square the edge of the tool and remove nicks by light grinding, holding the tool head-on against the wheel.
- Grind the bevel, holding the tool at an angle midway between the center and top of the wheel. Dip the tool frequently in water to keep it cool.
- Whet the tool on the fine side of a flat oilstone, rubbing it alternately on the bevel and on the flat side until you eventually notice a fine burr forming along the edge; this is the wire edge and whetting should continue until it starts to drop off. Keep the stone wet with light oil at all times.
- Switch to a Hard Arkansas stone for the final honing to remove the last trace of the rough wire edge.

A final operation, stropping, is used by woodcarvers and expert craftsmen. Draw the tool across a leather strap glued to a flat board. This puts the final polish on the edge, making it keen enough to snick the hairs off the back of your hand.

***Sharpening with power.*** After the first few sessions with an oilstone, you'll prob-

**THIS TINY GRINDING WHEEL,** driven by a high-speed hand grinder, is just right for sharpening irregularly shaped cutting edges—gouges, wood-turning and carving chisels. Use it, too, for taking nicks out of the curved edges of molding cutters and router bits.

**CLEAN AN OILSTONE** of metal particles and gummed oil by scrubbing it with kerosene, as above. A special tool or diamond is used to dress and remove glaze from a grinding wheel.

ably start dreaming of replacing elbow grease with power. If you have a bench sander, fit it out with a metal-finishing disk or belt. Or make abrasive sharpeners by cementing aluminum-oxide cloth to plywood disks or turned hardwood drums. Face them with coarse and fine abrasive for fast cutting and smooth finishing.

You can safely use an unguarded abrasive disk or drum, but hold the tool so the abrasive rotates *away* from the edge to keep from snagging the tool in the cloth.

Almost any rotary tool in your shop can be used to drive abrasive sharpeners. Disks can be used in a table saw; drums in a drill press, lathe or polishing head. A spare motor can be set up for sharpening simply by mounting a disk or drum on a suitable arbor. A small sanding drum chucked in a flexible shaft makes a fine all-around sharpener for broad-edged tools.

Abrading metal produces sparks, and although they'll usually be flying away from you, it's smart to wear goggles. Keep a can of water handy and dip the tool in it often. Abrasives will heat the tool, and some steels lose their temper at temperatures as low as 250 degrees.

***What about a grinder?*** You'll want one sooner or later. Hardware stores offer a tantalizing variety of grinding wheels at moderate cost. But you're inviting trouble if you simply mount a wheel on a sleeve arbor and run it uncovered on the shaft of a spare motor; a jury-rigged grinder is a hazard in any workshop. Unless you're equipped to build a heavy-steel guard around the wheel, better wait and buy a bench grinder.

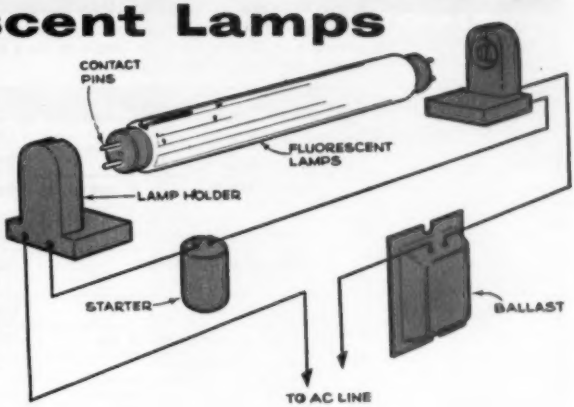
Even a modest one comes with two wheels—coarse and fine—completely enclosed for safety. Belt that spare motor to it and grind with confidence.

Once you graduate to a grinding wheel, certain precautions must be observed. It's a hard, brittle wheel that is perfectly safe if properly used. Abused, it's a bomb. Most of your grinding jobs will be on the edge of the wheel, but if you must use the side, go easy. Side pressure can shatter a wheel to bits. No fault of the wheel, just yours.

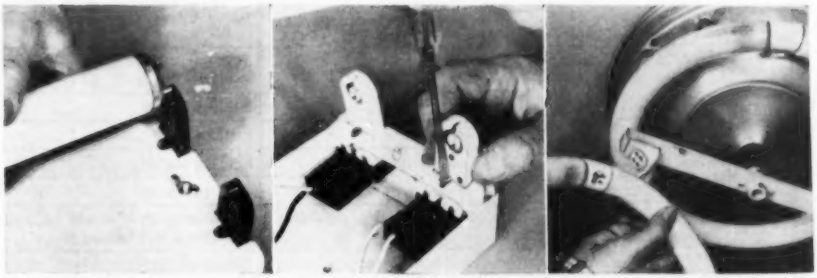
A small hand grinder is another useful sharpening tool. Fitted with shank-mounted abrasive or grinding wheels, this tool makes short work of dressing irregular cutting edges. END

# Fluorescent Lamps

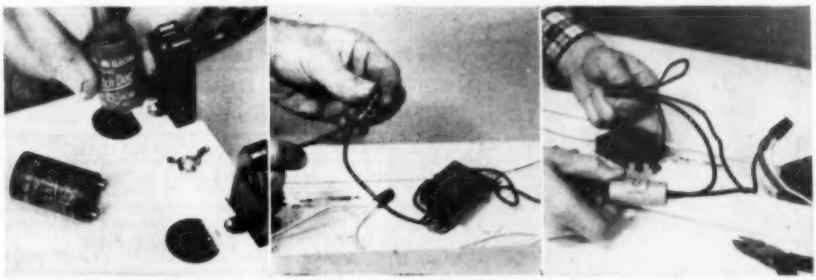
**TYPICAL CIRCUIT** for a single-lamp fluorescent fixture is shown here. The starter heats the filaments at the tube ends to start electrons flowing through a gas. The gas emits ultraviolet radiations, and the phosphor coating inside the tube absorbs this energy and converts it into visible light. The starter then opens its contacts to break the circuit to the filaments. Lamp and reflector must be kept clean and dust-free for maximum light output.




## *How to service fluorescents*



**TO CHANGE A LAMP** or remove it, twist the glass tube a quarter turn to slip the contact pins out of their clips and align them vertically. Then pull the lamp downward. If a lamp seems insecure or moves from side to side, loosen the screws (center) and shift the holders inward. Circular lamps have four end pins grouped together. To remove, swing the tube free of the spring clips, then pull the pin section straight out.



**THE LITTLE STARTER "CAN"** is responsible for many lamp troubles—blinking, slow starting and short tube life. Press lightly and twist to remove. The wattage of the starter should match the wattage of lamp being used. If trouble is traced to the ballast, loosen wire nuts (center) to try a new one. Ballast may have two or three wires. Follow diagram printed on ballast or fixture. If radio hums when lamp is turned on, try relocating antenna at least 10 feet away from the lamp, or cut in condenser across power line (right).

# Fluorescent Trouble-Shooting Chart

Since there are only three major components to worry about—lamp, starter and ballast—the easiest way to locate and cure a troublesome condition is often simply to try a new part. The symptoms and related causes listed below may help you pinpoint your problem.

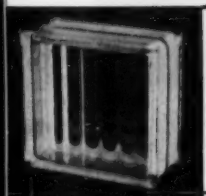
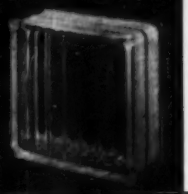
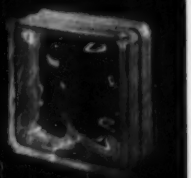
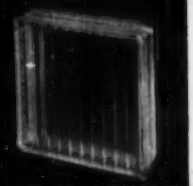
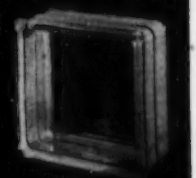
| SYMPTOM | POSSIBLE CAUSES | WHAT TO DO |
|---|---|---|
| Lamp won't start, or starts reluctantly | No current | Check fuse box; look for open circuit |
| | Defective on-off switch | Replace switch |
| | Starter sluggish or at end of its life | Replace starter |
| | Ballast defective | Replace ballast |
| | Filaments burned out | Install new lamp (first check for shorted holder or wiring) |
| Blinking on and off | Low line voltage | Check voltage and correct |
| | Lamp at normal end of life | Replace lamp |
| | Starter defective | Replace starter |
| | Lamp located in cold area or exposed to cold drafts | Enclose lamp, replace starter with thermal type, or use special low-temperature lamp |
| | Loose connection | Check holders and adjust if needed for firm pin contact<br>Check wire connections and terminal screws |
| Flicker or intermittent flashing | New lamp may flicker | Turn lamp on and off a few times; should clear up by itself |
| | Defective starter | Replace starter |
| | Defective lamp | Replace lamp |
| Ends (filaments) continue to glow after lamp lights | Shorted condenser in starter | Replace starter |
| | Starter contacts welded together | Replace starter |
| Short lamp life | Too-frequent starting | Leave lamp on if it will be used again within a half-hour or so |
| | Voltage too high or too low | Check voltage and correct |
| | Defective starter causing rapid blinking at each start | Replace starter |
| Reduced light from lamp | May only be difference between old lamp and new one | Replace lamps in pairs, saving usable one for later replacement |
| | Dust or cooking vapors on lamp or reflector | Clean with soap and water |
| | Cold drafts hitting lamp | Enclose or protect lamp |
| Blackening at ends of lamp | Lamp at normal end of life | Replace lamp |
| | If new lamp blackens early in life, material is being sputtered off electrodes by a defective starter | Replace starter |
| | Voltage too high or too low | Check voltage and correct |
| Brownish rings near one or both ends | Normal on many lamps | Won't affect performance |
| Noise: steady or intermittent hum | Slight transformer hum normal; sometimes causes fixture parts to vibrate | Tighten all screws; wedge louvers or glass panels in place |
| | Short in ballast | Replace ballast |
| Radio interference | Buzz in radio when lamp is turned on | Relocate antenna away from lamp; install condenser or interference filter at fixture |

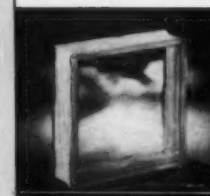
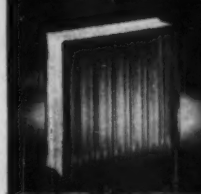
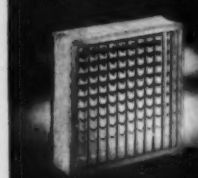
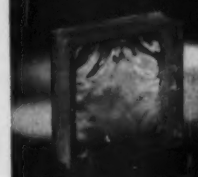
# The Basic Facts on Glass Block

AS A building material, glass block is much more versatile today than it was when introduced at the 1933 World's Fair in Chicago. Besides the original virtues of low upkeep, good insulation against heat loss and noise, and modularity with brick and concrete block, the present range of glass block offers:

- Variety in design. Roughly a dozen different surface textures are available.
- A choice of four sizes. Blocks come 6″, 8″ and 12″ square. There is also a 4″-by-12″ rectangular one. These are nominal sizes—actual dimensions are ¼″ less to allow for mortar joints. All measure an actual 3⅞″ thick.
- A choice of 12 colors (besides colorless): light and dark blue, light and dark green, red, coral, yellow, white, black, walnut, orange and gray. Colored blocks are smooth-surfaced, come in 6″ and 8″ squares, and 4″-by-12″. The color, a ceramic-enamel layer, is sprayed

# Glass Blocks for Decorative and General Uses

| PITTSBURGH CORNING | DESCRIPTION | SIZES (in.) | PRIVACY |
|---|---|---|---|
|  | **ARGUS:** Smooth outer faces with rounded flutes on inner (cavity-side) faces. Flutes at right angles to each other. High light transmission | 6<br>8<br>12 | GOOD |
|  | **ARGUS PARALLEL FLUTES[a]:** Same basic block as the Argus, except that flutes on inner faces are parallel to each other | 6<br>8<br>12 | FAIR |
|  | **DECORA:** Outer faces are smooth. Design is pressed into inner faces. Can be laid in any position. Almost transparent, gives high light transfer | 6[c]<br>8[c]<br>12 | LIMITED |
|  | **SAXON:** Shallow, narrow reeds on outer faces, parallel to wide flutes on inner faces. Inner faces slightly etched. Good light transmission and uniform brightness | 12 | COMPLETE |
|  | **VUE:** Outer and inner faces are smooth and clear. Frequently used in panels of other patterns to provide a vision area. Can be laid in any position. High light transmission, good visibility | 8<br>12 | NONE |
| | **4 by 12[abc]:** Outer faces are smooth, inner ones textured by etching. Can be laid horizontally or vertically, by itself or in combination with the three sizes of square block | | FAIR |

| OWENS-ILLINOIS | DESCRIPTION | SIZES (in.) | PRIVACY |
|---|---|---|---|
|  | **31:** Smooth-faced, with slightly uneven configurations on both inner faces. Random design gives appearance of hand-made Colonial glass. High light transmission and brightness | 8[c]<br>12 | LIMITED |
|  | **40:** Flat ribs on outer faces. More pronounced ribs on inner faces. Faces lightly etched for diffusion. Rib arrays on all faces parallel. High light transmission and brightness | 8<br>12 | GOOD |
| | **70:** Smooth-faced, clear design for vision. Unusual egg-crate or louver effect if used in big panels. Often inserted in block panels of other designs for vision. High light transmission | 8<br>12 | NONE |
| | **07[a]:** Smooth-faced with convex ribs on inner faces. Ribs are parallel to each other. Blocks can be alternated for basketweave effect. High light transmission | 8<br>12 | LIMITED |
|  | **16[a]:** Smooth-faced with convex ribs on both inner faces. Ribs are perpendicular to each other. High light transmission with sparkling effect | 6<br>8<br>12 | FAIR |
|  | **30:** Smooth-faced with repetitive circular design on inner faces. Face design deemphasizes mortar joints. High light transmission and brightness | 6[c]<br>8<br>12 | FAIR |

**NOTES:** [a] Also comes with white filter inside for diffusing light; [b] also comes with green filter inside for reducing glare and solar heat; [c] also comes in ceramic-faced color. PC offers 12 colors, O-I offers 4.

on one side only. Some light passes through.

• Control of daylight. Prismatic designs on the interior surfaces of some blocks refract, diffuse or reject light.

• Ease of installation. Blocks are laid with mortar. But for indoor partitions and space dividers only, you can now use simple aluminum rods with plastic rosettes to hold blocks together.

***You can use blocks indoors or out***—to replace a window, as part of an exterior house wall, as an interior space divider, as a skylight, as a privacy-giving wall in the yard, to list some possibilities.

Rain or the moist atmosphere of a bathroom doesn't affect them. The only upkeep required is periodic washing, like a window. Blocks can withstand a 75 m.p.h. wind, far more than a window pane.

Heat flow through glass block—it's hollow, remember—is only 30 to 75 percent of what it is through window glass. (The filter inside some blocks cuts heat loss, too.) Sound can be muffled down, it's claimed, from the noise level you'd encounter in the average factory to that of a quiet home. Heat and sound insulation increase with block size; there are fewer conductive mortar joints.

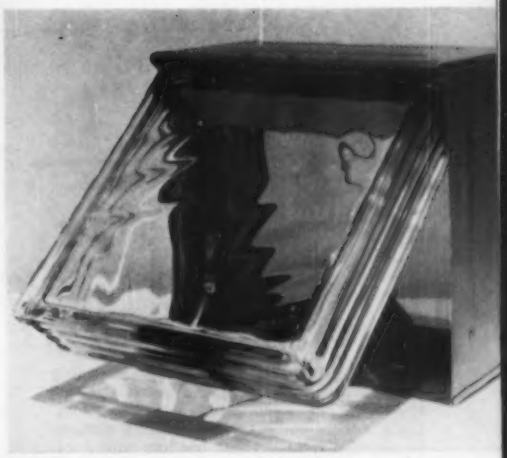
You may hear it said that block has a compressive strength of 400 to 600 pounds per square inch. Don't let that mislead you into thinking it can be used as a load-bearing wall. You must frame around block as you would around a window. Block weighs about 20 pounds per square foot of wall area.

***What does it cost?*** In small batches the 6″ size averages about 65 cents each, the 8″ size about 90 cents, the 12″ size about $2.55. The 8″ size offers the widest variety of types. The 4″-by-12″ rectangular blocks will cost you about $1.80 apiece. Color roughly doubles each price.

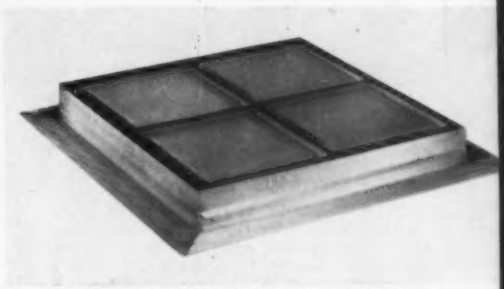
When figuring the cost of a job, remember that glass block forms a finished wall on both sides. There are no extras for siding or wall covering.

You can still have air through a glass-block wall. Ribbon windows that open are made in modular sizes to take the place of one or more block courses. And one special block has a vent you can open. It comes in six patterns to match decorative block.

Before choosing a block, you should consider: 1) how much privacy you want; 2) which direction the block will face.



**VENTILATOR UNITS** fit into 8″-block panels. Aluminum frame has a hinged block-face outside, screen inside. Block face, moved by a rod from inside, matches Owens-Illinois designs.



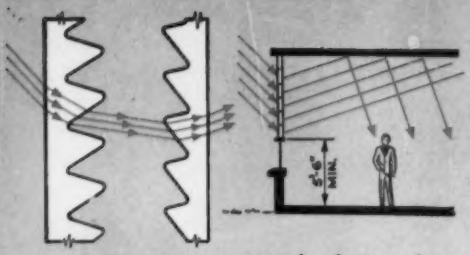
**SKYLIGHT PANELS** of 12″ block are prefabbed in aluminum frames by O-I. Blocks reject hot sunlight, diffuse daylight. Standard sizes: 2′ by 2′, 3′ by 3′, 4′ by 4′, 2′ by 6′, 3′ by 6′.

Block surfaces range from plain glass you can see through clearly to very rough surfaces that are acceptable for a bathroom wall. The design you choose will determine the degree of privacy you get. You can, of course, mix blocks—using clear glass up high and a rough surface lower down.

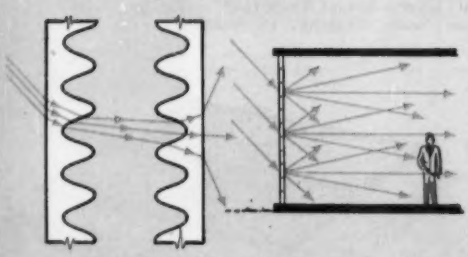
***Controlling the light.*** Clear-glass blocks or opaque ones with various surface textures are fine for inside partitions and exterior walls that do not face the sun, notably north exposures. You might also use such blocks on the sunny side of the house along with drapes.

But when drapes are not desirable or

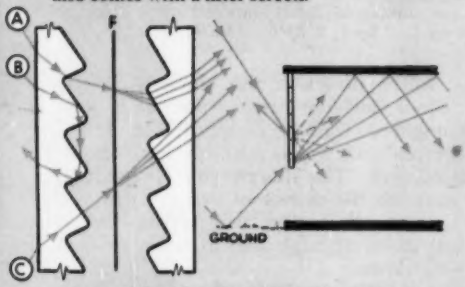
## Functional blocks direct, diffuse or select light rays




**LIGHT-DIRECTING BLOCK** bends incoming daylight up to the ceiling. This distributes the light evenly around the room, eliminating shadows and reducing glare. This type is especially suited for use on sunny exposure in a large room with a light, reflective ceiling and upper walls.



**LIGHT-DIFFUSING BLOCK** scatters light around room in every direction. Brightness is well controlled, light distribution good, but block does not throw light as far into a large room as light-directing block. A general-use block for all sun exposures, it also comes with a filter screen.




**LIGHT-SELECTING BLOCK** transmits cool light rays reflected from the ground and high-angle light from the sky. But hot rays direct from the sun, coming from the region about 45 degrees above the horizon, are turned back by block's internal prisms. It's designed for bright sun exposures.

feasible, you will want to consider the kinds of block that control daylight.

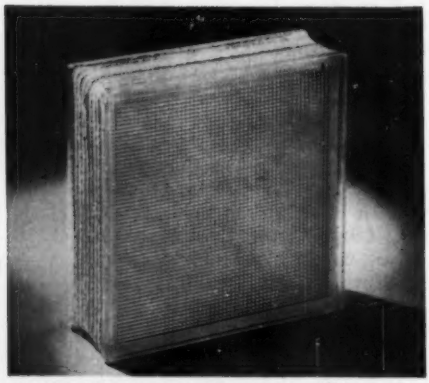
Light-directing blocks throw incoming daylight onto the ceiling, where it's reflected downward evenly. This type is best for large rooms, where deep penetration of daylight is wanted. Two cautions: The ceiling should be a light color (white is best). And these blocks should be installed no lower than 5'6" above the floor, preferably in continuous panels the full width of a wall.

Light-diffusing blocks split up the sun's rays, spreading them around. For that reason, penetration of light into a room is less than with light-directing blocks.

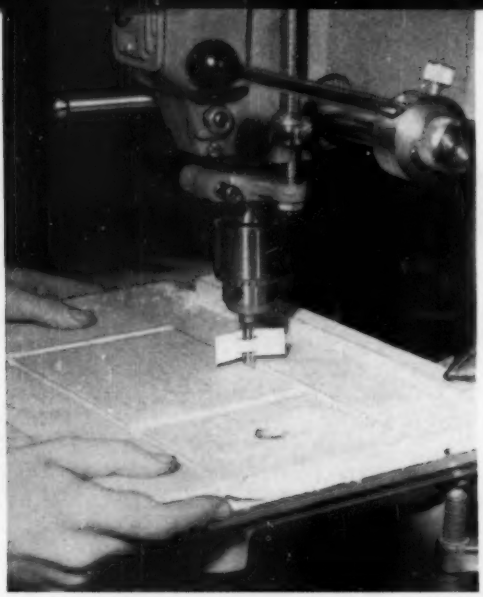
The light-diffusing type should be installed above or below, not at, eye level. They make a good bottom section for a wall with light-directing blocks in the upper part.

Selective block is for controlling extreme brightness, as in warm climates where the sun can be oppressive. It rejects direct sunlight when the sun is hottest by reflecting light back that comes from the section of sky about 45 degrees above horizontal. At the same time it transmits cool, indirect light from high in the sky and from the ground.

Selective blocks come with or without a glass-fiber filter. The filter reduces light transmission sharply; it's used where extreme brightness is a problem. Another advantage of the fiber filter is that it creates two airtight cavities, increasing the block's insulating value.



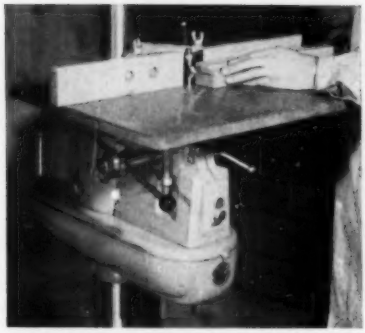
**FUNCTIONAL BLOCKS LOOK ALIKE:** All have thin diffusing ribs on exterior and interior faces. Outside ribs are vertical, inside ones horizontal. A fiber filter inside cuts light, glare, heat.



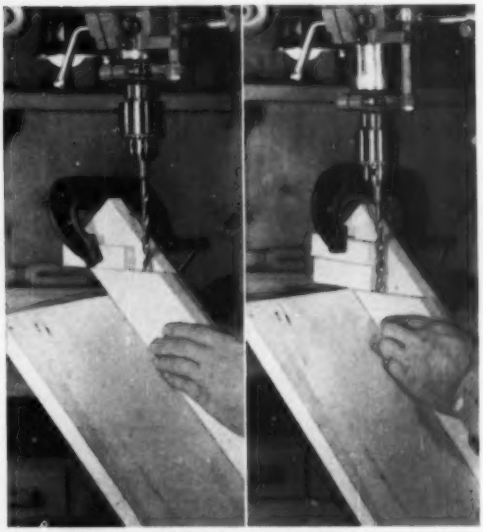
# 4 Drill-Press Tips

**1 A BLOWER,** made by slitting a piece of stiff card and slipping it over the bit, will clear the work area of chips. The dodge is especially effective when you're routing, as chips are plentiful and tend to pile up on the work around the bit.

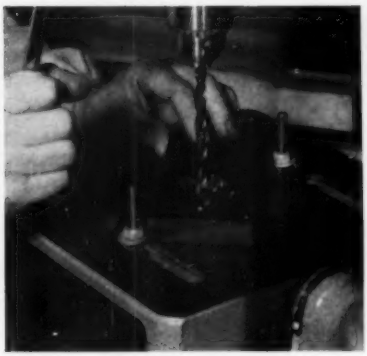
*Ideas and photos from Delta Power Tool Division, Rockwell Mfg. Co., Pittsburgh*



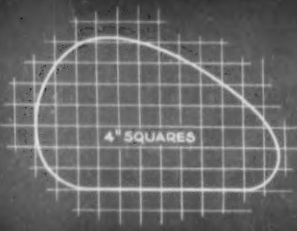
**2 TURNING A DRILL-PRESS HEAD** upside down on its supporting column and bolting a plywood square to its table converts it into a table shaper. An adjustable fence can be bought, or wood strips can be clamped to the table as guides.



**3 DOWELING FRAMES** for screens or storm windows? Space out the holes this way and mating pieces will always line up. Cut the pieces to size and miter the ends. Then set the drill-press table to 45 degrees and chuck the bit. Clamp on a fence to center the thickness of the stock under the bit, and clamp a stop block to the end of the fence to locate the first hole (left photo). To position the miter for the second hole, insert a spacer block as shown at right.



**4 TO KEEP WORK FROM ROTATING,** lock stop bolts in place in the table slots. One bolt will keep work from slipping out of your grasp if the drill grabs, but two can be arranged as shown at left to center the piece on the table crosswise under the drill.




*Big coffee tables are now in fashion for the big living rooms of modern homes. But prices are pretty big, too, when you set out to buy one. So why buy one? Build your own. The cost of materials is only a fraction of the cost of a store-bought table. This one is about four feet long and 2½ wide, shaped in easy curves as you see in the sketch. But there's no need to stick to this design. You can work out your own.*

*A picture story showing how you can make a*

# Coffee Table in Modern Free Form

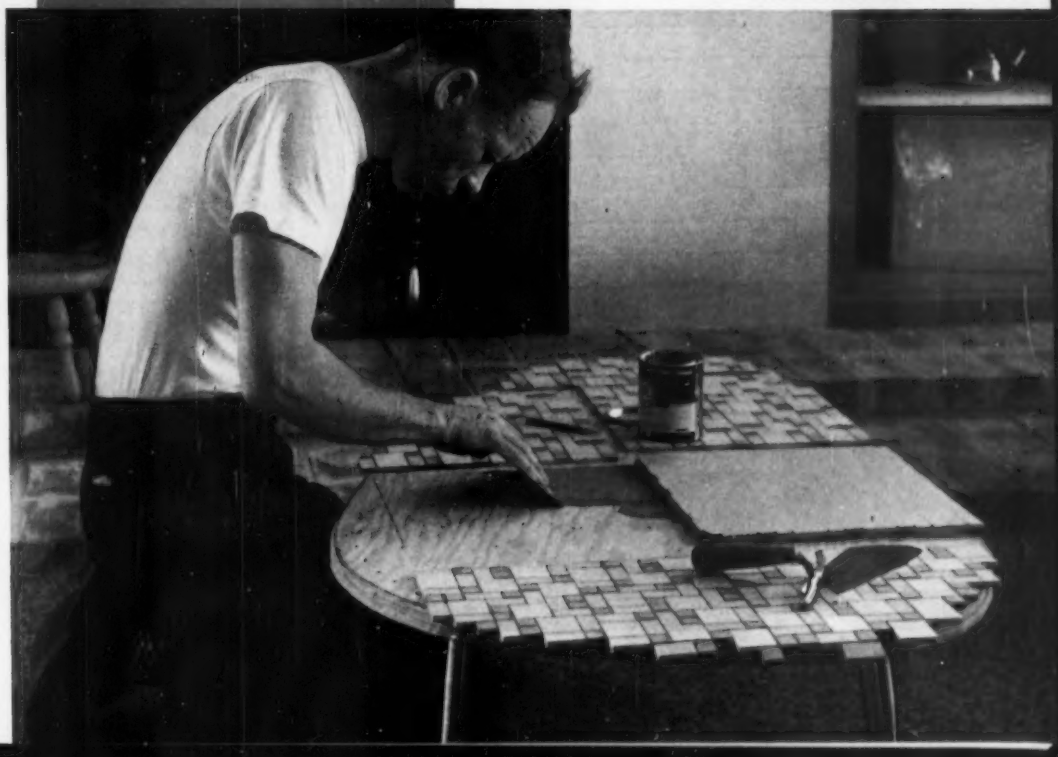
By John Burroughs

**1** *Two sheets of ½" plywood (low-grade stock will do) form a solid top. Glue and nail them together. Mark your design on the wood.*

**2** *A pro might bring the top to rough shape with a table saw, as here, then sand off corners. But a bandsaw or saber saw is better.*

**3** *Ready-made wood or metal legs 13" high fit firmly into screw-on brackets. Or you can turn legs of your own special design on a lathe.*

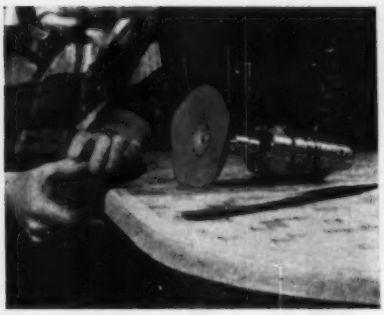
**4** *Ceramic tile is a durable surface. Small tile comes in foot-square sheets at about $1 a square. Apply with adhesive. Paper soaks off.*



**5** *A cut-off wheel in a table saw is one way of shaping tile to table edge. But wear goggles. Cutter borrowed from dealer is safer.*

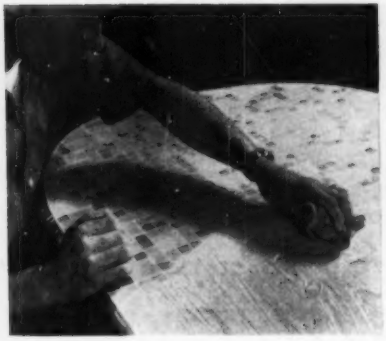
**6** *The shaped tiles should be dabbed with adhesive, then installed on the edge.*

**7** *Four or five layers of thin mahogany or ash form a laminated edge around the top. The strips are glued and nailed to one another. Joints between them should be staggered for best appearance.*



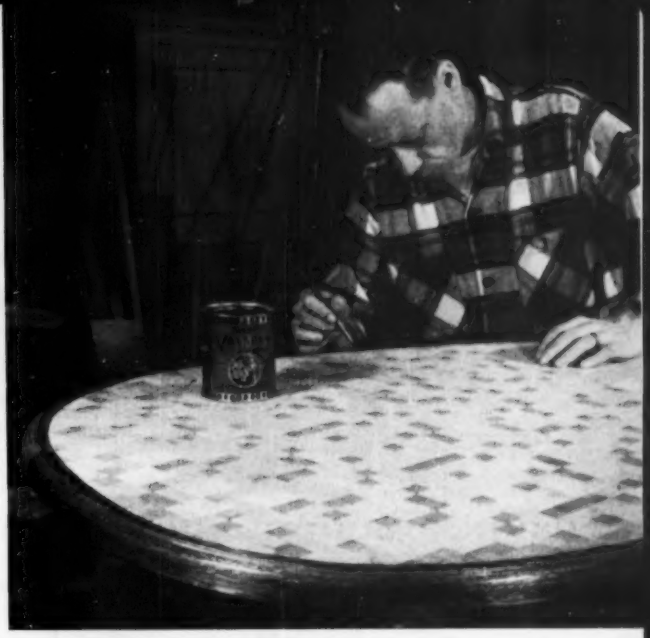
**8** *Edging is rounded off on top and bottom, and sanded smooth after the nailheads have been set.*

**9** *A half-dozen coats of top-grade bar varnish finish off the edging. Sand it lightly between coats and rub final coat with rottenstone in oil.*



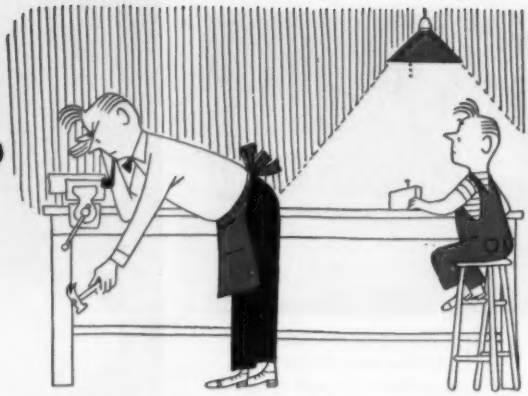
**10** *Grouting—the final step—is done by forcing heavy, pastelike cement into joints between the tiles. Excess is wiped off wet.*

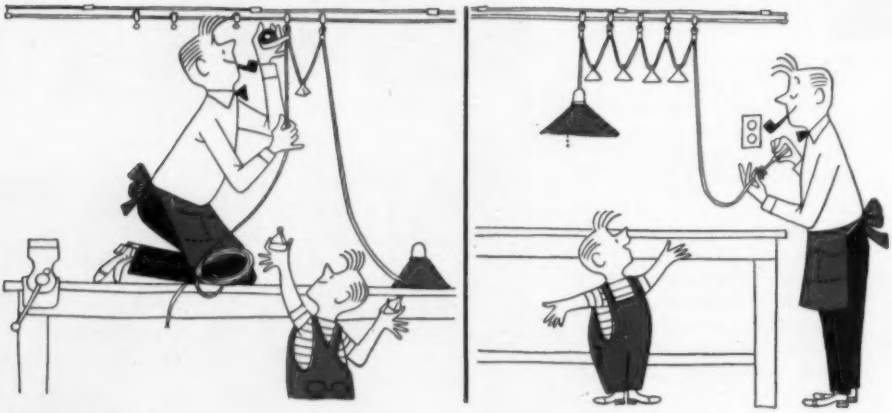
**11** *And here's the table in use—spacious, colorful, waterproof. You don't have to restrict yourself to ceramic tile, of course. Marble is another good bet.*

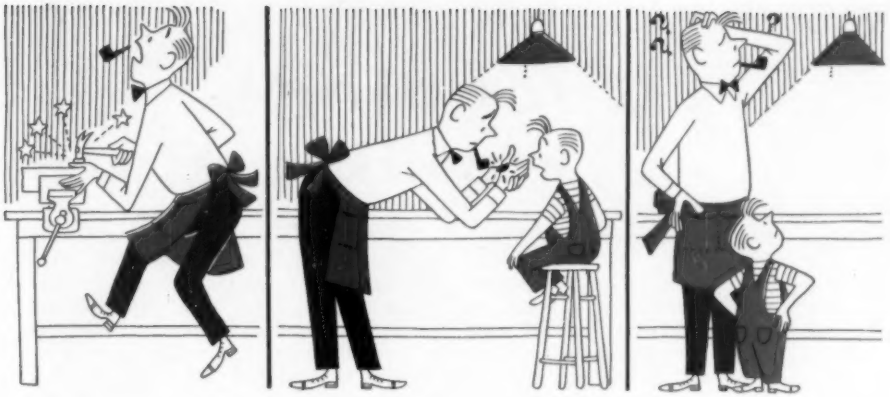


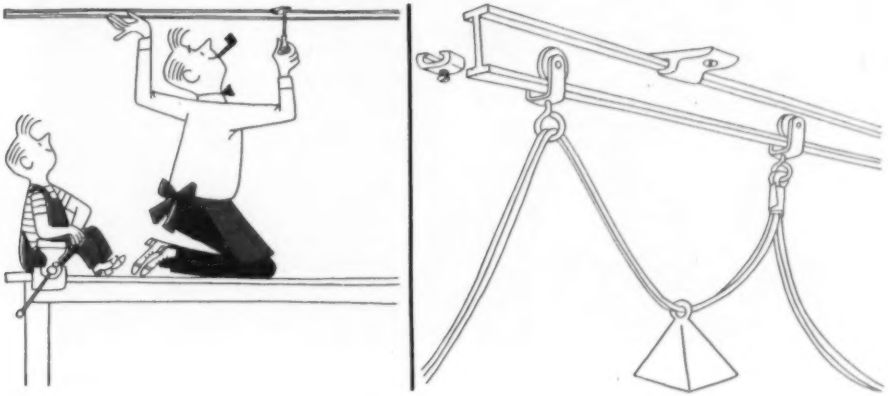
# Wordless Workshop

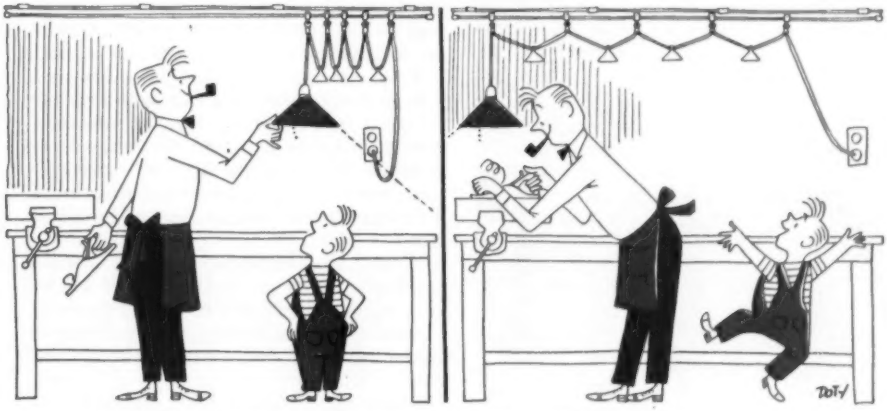
By Roy Doty
and Harry Walton












***Next Month: Hinged bed tables that swing within reach***

*One man's thoughts on*

# Choosing a Flexible Rule

**By R. J. De Cristoforo**

I'LL bet I've bought enough steel-tape rules to match the price of a pretty good jigsaw. Right now perhaps half a dozen are kicking around my shop. Yet the only one I use is the last one I bought. And I readily admit that this selection, like most of the others, was prompted mainly by the feel of the case rather than the tape's features.

That's why I was more than casually interested when I walked in one evening on a neighbor who works for a hardware distributor. Spread over the dining-room table was a huge array of flexible rules.

After Jim had seated me far enough from the shiny cases so I couldn't touch, he explained that his company was taking on tapes as a new line.

**MEASURING STRAIGHT UP** as high as 16 feet is possible with my favorite rule. The blade is ¾" wide and coved to make it more rigid.

"I can give you one hint that will make you a fortune," I said generously. "Just have a sculptor design the cases."

Jim laughed. "Maybe so," he said, "but flex rules have already come a long way; they can measure almost anything."

***Rules for everyone.*** He showed me a rule for loggers. You measure the length and diameter of a log and the rule tells how many board feet can be cut from it.

Another flex tape measures megacycles —in terms of antenna lengths—for electronics technicians and hobbyists. A special engineer's rule is graduated in tenths and hundredths of a foot. Printers can get one marked in agates and picas. There is a rule that will measure both by inches and meters, converting at a glance from one system to the other.

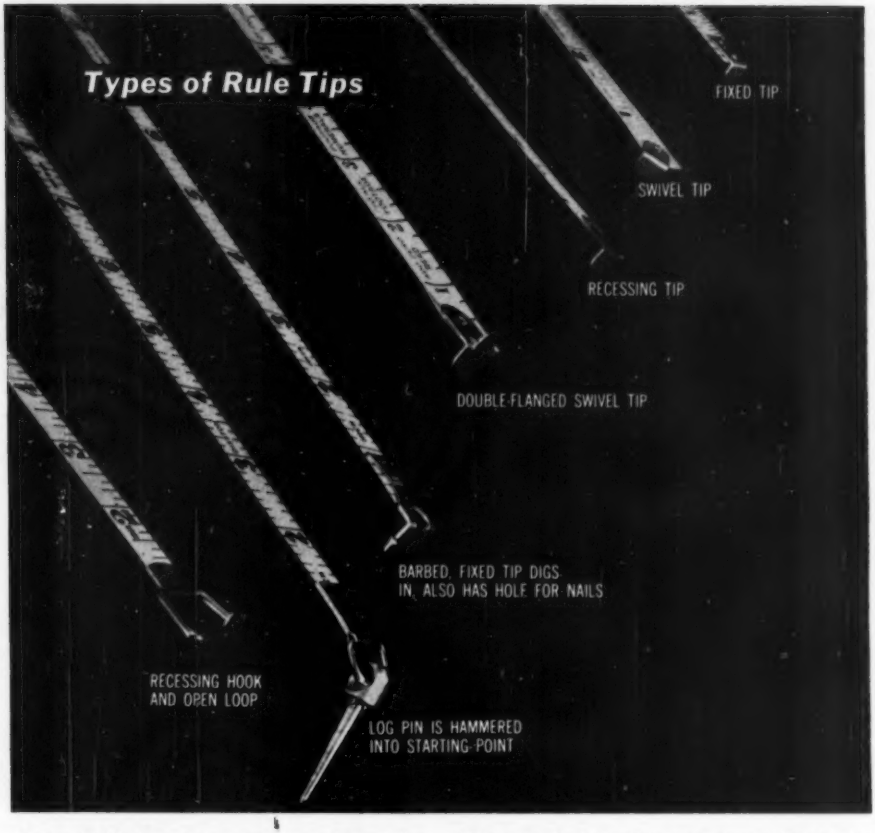
As Jim described the variety of blades and tapes (under 16′ it's a *blade* and over that a *tape*), I realized how little most of us really know about them. I thought, too, about my own experiences with measuring instruments.

My first rule was donated by Dad. The blade came in a small, round case. It never snagged in my pocket as some of the square ones do. But taking inside measurements was tough because it had a fixed tip. This had to be compensated for and so did the round case, which couldn't be incorporated into the measurements.

***Tips on tips.*** The next one was in a square case and had a movable tip that recessed into the blade for butt measurements. But sawdust and dirt sometimes jammed the recessing tip and caused errors when I took inside measurements. This experience left me partial to swivel tips.

That first movable-tip rule also brought home the value of finding out if blades are replaceable. When I accidentally kinked the blade beyond repair, I had to throw the whole deal away and buy a new rule.

Along about this time I decided, too,




that a 6′ blade was a poor investment for anyone who worked a lot with plywood panels—which measure at least 8′ the long way.

So the next one I bought had a square case, a 10′ replaceable blade and a good swivel tip. Then one day I tried to measure across an opening with it and discovered that the blade was too flexible to span the gap.

Another try, this time with a blade ¾″ wide and coved for further rigidity, proved that you *could* span a 4′ or 5′ gap with a flexible blade. But the darned thing wouldn't remain extended.

***The ideal rule.*** All of which goes to prove that even such a small workshop tool as a flex rule should be selected carefully. As I told Jim the other night:

"You've got dozens of blades and tapes there, but all I want is one. It should be in a square case, have a 12′ replaceable blade that's ¾″ wide and coved. It should have a strong swivel tip, black markings on a white background and a protective finish. Measuring should be possible in both running inches and feet and inches, with graduations by eighths and sixteenths of an inch. I want stud locations marked on it, too.

"The rule should be able to extend 4′ or 5′ horizontally, unsupported, and twice that distance vertically. It should remain extended, yet be easily pushed back into the case. That's all I want, just one."

Jim picked a tape out of the assortment on the table without hesitation and handed it to me. "Oh, no, not this one!" I exclaimed after hefting it in my hand. "It fits my description all right, but somehow it just doesn't feel right."

A fussy point? Sure. But I'm confident that someday I'll find my ideal rule—and that it'll feel right, too. END

# New Headlamps Upgrade 2-Lamp Cars

**By Herbert R. Pfister**

CONSCIOUSLY or not, your eyes seek out the right side of the road as the headlights of an oncoming car bear down on you at night. What your eyes normally see clearly ahead of you is washed out by the glare of the other fellow's lights. For a brief instant both of you could probably see better with only a flashlight.

A new sealed-beam lamp, designed specifically for cars with two single headlights, sends its low beam farther down the right side of the road. This long-reaching spotlight effect provides a dark area for the other driver to slip through unblinded, while it throws light well beyond 400 feet in your lane. With such a range, speeds well over 50 are possible (assuming they're legal) before you begin to outdrive the headlights. The high beam of the new lamp blasts out at everything ahead, as high beams always have.

**Auto Upkeep**

If both cars are equipped with the new lamps, or if the oncomer is piloting one of the four-headlight jobs, you should, theoretically, slip past each other on a straight road without so much as a blink. The light quality and placement of the low beam is said to approach that of the four-light system. Of course, if you hit the other driver in the eye on a curve with your concentrated beams, he may snap on his brights out of spite. But until engineers figure a way to bend the beam around a curve, there's not much that can be done.

Even if the other fellow doesn't dim his lights, the new lamps make things easier. Your eyes adjust, closing down like the iris of a camera under bright light. It then takes several seconds after the other car zooms by for them to readjust to the darker road ahead. By putting more light on the road ahead, the new lamps soften the extremes and lessen the readjustment time. This, plus improved visibility in fog, rain and snow, makes for more eye comfort and safer seeing.

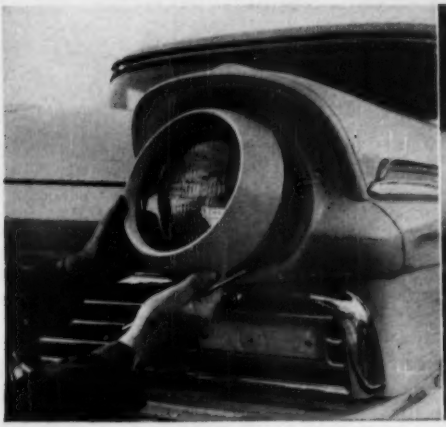
***Poor aiming cancels the benefits.*** Simply installing the lamps is not enough. In order to reach out better than 400 feet and still keep in lane, the beam must be aimed right on the nose. A beam only six inches off target at 25 feet will be 16 times as inaccurate at 400 feet—eight feet off the road at a point where you need visibility most. If the error is to the left, you're throwing oncoming drivers a curve all the time, besides reducing your visibility range to the point where the beam jumps out of your lane.

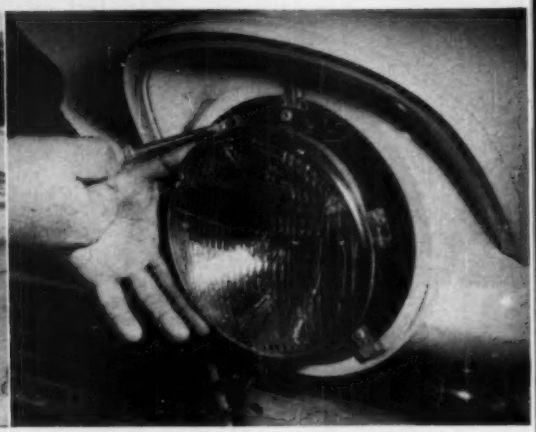
If you have your headlamps aimed for

**EVEN THOUGH DIMMED,** lights from oncoming car make it difficult to see a box on the road 200 feet ahead. With old headlights, objects that far away can be seen only when road is dark.

**THE NEW HEADLAMPS** send out a long beam in your lane. Now the box is clearly visible and a 400-foot marker and a railroad crossing considerably beyond it are bathed in light.

**WHEN HIGH BEAMS APPROACH,** seeing is always more difficult. But the searchlight effect of the new low beam helps you to penetrate headlight interference and just make out the box.





**TAKE OFF THE TRIM RING,** usually by removing a single screw at the bottom. Pull the ring outward at the bottom, then lift it up and off the retaining tab at the top. Loosen the retaining-ring screws (above, right) but don't remove them. Rotate the ring slightly and slip the large side of the mounting holes over the screwheads. (The aiming screws, usually at top center and side, need not be disturbed in replacing a lamp.) When removing the ring, take care that the

you, go to a garage that has a mechanical aimer. Used with the aiming buttons molded on the lamp lens, these aimers pinpoint the beam without even turning them on. The "hot-spot" aiming method —adjusting the beams against a screen or blank wall—is accurate, but it must be done with a degree of care seldom taken by a hurried mechanic.

***You'll enjoy doing the job*** yourself if you like to fuss. Here's how it's done: Place the car on reasonably level ground, 25 feet away from a blank wall—the back of your garage, or a garage door. A white surface is best. Jounce the car to settle it on its springs. Stand on the rear bumper and sight through the center of the car, along the hood ornament or center crease. Have someone stick a piece of tape on the sighting point.

Support a yardstick vertically beside the center of each wheel on one side of the car and, standing a few feet behind the car, sight across the tops of the sticks. Mark this spot on the garage door or wall. Repeat on the other side.

Now measure the center height of the headlights from the ground and shift the tape to mark their true centerline on the wall (if headlight height is 32″ above the ground, move the yardstick-sighting tape 4″ down).

Finally, measure the distance between headlight centers and place vertical tapes on the wall, equally spaced from the sighted centerline tape. Add a horizontal strip across the two height tapes and the aiming screen is complete.

When it's dark enough, remove the trim rings on both headlights, turn them on low beam and cover one while you adjust the other. Adjust the vertical aiming first as you have a broad horizontal line to work to. Back off the top adjusting screw to drop the beam down, then slowly turn it inward to raise the beam up to and barely overlapping the horizontal line.

Next back off the lateral adjusting screw at the side of the lamp and turn it in to swing the beam over to the right. Stop when the left edge of the beam's high-intensity zone crosses over to the right side of the lateral aiming line. With both lights uncovered, you will then have a low-beam light pattern similar to that shown in the drawing. This automatically sets the high beam correctly.

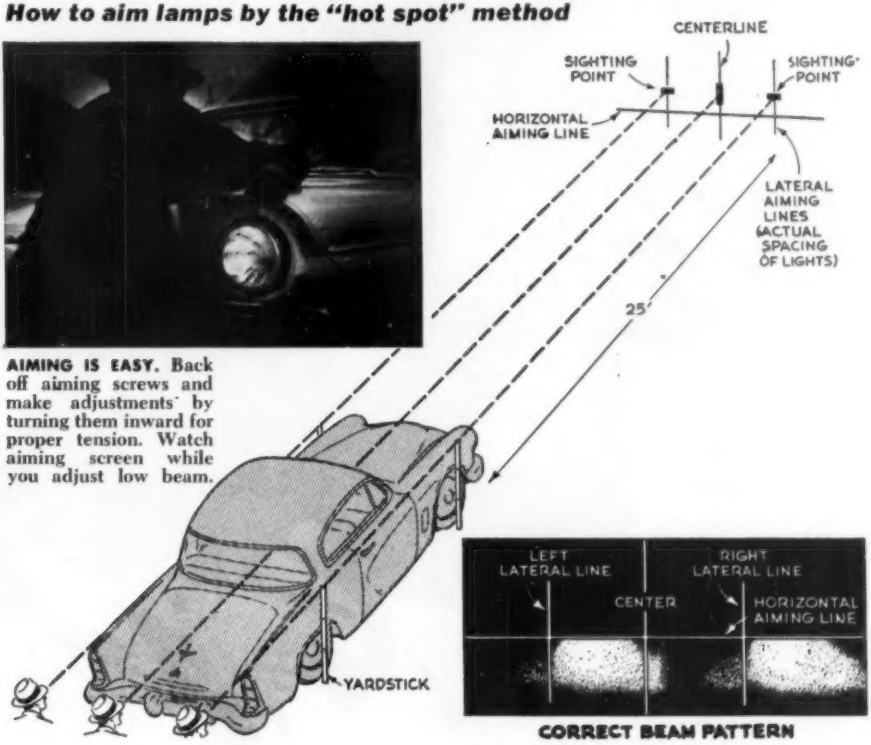
You'll find the new lamps selling under several trade names: "Suburban Headlamp," made by General Electric; "T-3 Powerbeam 50," by Guide Lamp; "Town and Country Safe-T-Beam," by Westinghouse; "Vision-Aid," by Tung-Sol. All are made for six and 12 volts.

lamp doesn't fall forward. Now, holding the lamp, pull back on the three-pronged connector at its base (far right). If it's stiff or appears to be frozen, jiggle it gently to work it off the prongs. To install the new lamp, reverse the procedure used to remove the old one. Press the connector firmly on its prongs, place the lamp in top-up position and install the retaining ring. If you plan to aim the new lamps yourself, leave off the trim ring and see sketch below.

## *How to aim lamps by the "hot spot" method*



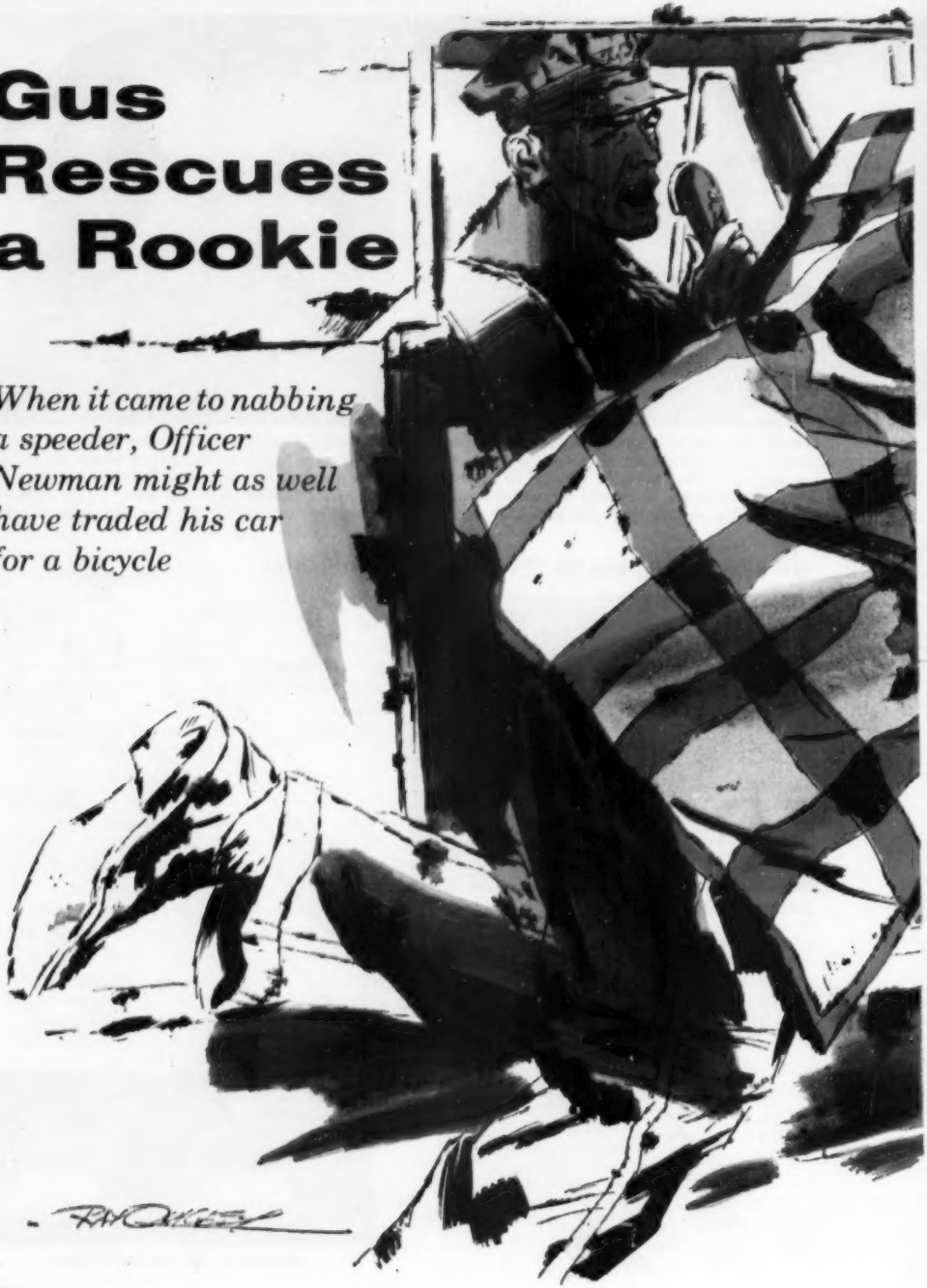
**AIMING IS EASY.** Back off aiming screws and make adjustments by turning them inward for proper tension. Watch aiming screen while you adjust low beam.




**CORRECT BEAM PATTERN**

# Gus Rescues a Rookie

*When it came to nabbing a speeder, Officer Newman might as well have traded his car for a bicycle*



*"Wait! Give me just 30 seconds," Gus urged as he scrambled out.*

**By Martin Bunn**

THE rookie cop from Centerville floorboarded the gas, flipped on the red flasher, and kicked down the siren button with the cool efficiency of a veteran. The hopped-up police car dug out fast—on the tail of a speeding red convertible.

"Seems to take off pretty good," observed Gus Wilson as he snugged up his seat belt and clamped down tighter on a cold pipe.

"Wait till we get going!" the young officer shouted above the mounting howl of the siren. "That's when it happens."

As he spoke the car was seized with a fit of knocking and bucking. The young cop gritted his teeth. "Guess we'll have to give up the chase," he said bitterly.

The unexpected engine behavior puzzled Gus, as did the desperate anxiety of the clean-cut, earnest young man at his side. He had come to the Model Garage, introduced himself as Ted Newman, and explained that he was new on the Centerville police force, still on probation—and that he was in trouble because of his car. That had been enough for Gus to leave his assistant, Stan Hicks, in charge of the shop and go trouble-shooting along the highways.

"See what I mean?" Newman said glumly now, bringing the car to a stop off the side of the road. "If I can't catch an ordinary speeder, where would I be in a real emergency?"

"Take it easy, son," Gus said, unfastening his seat belt and climbing out. "You may need colder spark plugs. I'll just take

a look." After a quick inspection he looked up from under the hood and shook his head. "Nope," he said. "You're running on J-2s now, and that's about the coldest plugs you can get by with."

"I know, Mr. Wilson. The mechanics at our police garage put them in. And they checked the timing, carburetor, distributor, and even installed a new head manifold gasket. Now they think I'm pulling some trick to make monkeys of them."

GUS mentally ticked off the possible trouble-causers. "I don't get it," he said, climbing back into the seat. "This car looks brand-new."

"It *is* brand-new, Mr. Wilson, and that's just the trouble. In Centerville we have to buy our own cars—city policy. A certain politician I won't name thinks that all police cars should be bought from his brother-in-law. I'm stubborn, I guess, but I bought mine from another dealer."

"But isn't your dealer responsible?"

"Oh, sure, but I don't dare go to him," Newman explained. "We have to use the police garage; they're strict about that."

Gus nodded sympathetically. "Guess they keep pretty close tabs on you during the probation period."

"That's right. Already the chief thinks there's something fishy that I haven't nabbed any speeders, and the other day the car went into its bronco-bucking act right in the middle of a high-speed civil-defense exercise, with the mayor and all the big shots there. If I get any more black marks against me I'll be off the force even before I make regular."

"So you decided to risk an out-of-town garage," Gus said.

Ted nodded. "Jerry—that's State Trooper Jerry Corcoran—knows about the fix I'm in and said you were the best auto mechanic in the state. So I came over on my first off-duty day, but I have to report back at four o'clock."

"Let's get going then, Ted—back to the Model Garage; we're not licked yet. And take what Jerry said with a grain of salt," he added.

Ted Newman's face brightened as he started the car and pulled back onto the highway. "Okay. Want me to try another speed run while I'm still in my own territory?"

"Good idea," Gus agreed. He watched the needle climb, edge past 80, his ears attuned for any warning sign of engine trouble. It came with shock suddenness—a hard, metallic ringing, then a chassis-shaking buck even more violent than before. "Detonation," he muttered.

"What?" yelled Ted, slowing down.

"Detonation," Gus said. "It's like the knock or ping you get from low-octane gas, or excessive spark-plug advance, or the pre-ignition I thought you might have from too-hot spark plugs. Only this is different, and a lot worse."

"You're telling me," Ted said in disgust.

Back at the Model Garage Gus went through the motions of some routine checks while he mulled the problem over. Then he had Ted start the motor, mostly to stop him from pacing nervously up and down.

"If they'd just keep me to escorting funerals I'd be okay," Ted said gloomily. He glanced up at a wall clock. "Gosh, I'm almost due back on duty."

Gus got up. "I'm going to try a new distributor cap. Won't take a minute, and we'll be on our way."

AS THEY arrived at a highway junction within Centerville city limits, Officer Newman checked his wrist watch, picked up the radiophone mike, and called his dispatcher at headquarters to check in for duty. A police-code reply came back over the loudspeaker.

"I got a standby signal," he told Gus excitedly. "Something's up."

Gus was listening to the engine, hoping his distributor-cap change had done the trick, when the radio squawk box broke into a chatter of rapid-fire instructions. Ted acknowledged the message and swung the squad car around sharply.

"What's that about a holdup?" Gus asked as the car picked up speed.

Ted was all business. "State Police call for assistance . . . setting up a roadblock . . . my post is at an intersection 15 miles out . . . bank stickup!"

"Gosh!" was all Gus could say.

"Just pray this wagon keeps going. And if we run into any trouble, better duck down to the floor so you won't get caught in a crossfire."

"Crossfire!" Gus repeated. "Why, Ted . . ." Just then the engine started to buck. "Stop her!"

"Can't now," snapped the panicky young officer, tramping down on the gas

Hydroplane racing proves that engines do their *best* with Champion spark plugs. The last 13 Gold Cup winners have been powered by Champions.

Q. Why do 9 out of 10 powerboat winners use Champion spark plugs?

A. These experts know spark plugs can win or lose a race. And Champions deliver the full-firing spark they need to win. For performance like this in your car, insist on Champions.

*World's favorite spark plug—engineered for every car built by Ford, General Motors, Chrysler, American Motors, Studebaker-Packard and every major foreign maker*

**CHAMPION**

pedal. Then, realizing the futility of trying to push the balky car any more, he eased the throttle and coasted to a halt, microphone in hand. "Got to call in for someone to cover the intersection for me."

"Wait! Give me just 30 seconds," Gus urged as he scrambled out and lifted the hood. Newman, mike still in hand, was about to call in when Gus was back. "Let's get going," he said.

*"You okay, Mac?"*

THIS time the speedometer passed 80 without a quiver, left 90 going away, and rested at well over 100 for the next five miles. Pulling up at the intersection, Ted radioed in his arrival. A jumble of police code answered him.

"Those crooks headed our way?" Gus asked excitedly.

"They've already been caught."

"Oh." Gus sounded disappointed.

Ted grinned. "Yeah," he said, "it would have been nice if I could have brought them in—but you saved my neck. If I hadn't been able to report in here on time, it really would have hung me." He turned, facing Gus. "Now, how did you manage to fix this thing in 30 seconds?"

"Crossfire," Gus said. "When you mentioned crossfire it flashed a light."

Newman shook his head. "Guess I'm thick."

Gus held up his two index fingers side by side. "Suppose these two were ignition wires. High voltage in one wire can induce a current in the other." He separated the fingers a bit. "Now, move them far enough apart, or cross them at an angle, and the induced current won't be hot enough to bother."

"But why all that noise under the hood?"

"Your firing order is 1-5-4-8-6-3-7-2," Gus explained. "Starting with the front right as 1, and going 1-2-3-4 on the right. 5-6-7-8 are on the left bank, again starting at the front."

Ted nodded. "The induced current was firing the wrong cylinders—crossfiring."

"It goes deeper than that. There are four throws on a V-8 shaft. In most cases the firing order jumps back and forth from bank to bank, but in the cases of 8 and 6, and 2 and 1, the next cylinder to fire is on the same bank and only 90 degrees behind the firing cylinder. Now, remember I said the wires had to be fairly close together and running parallel. Well, it's easy for that to happen with ignition wires on the same bank. The tricky part that sets the stage is having the combustible charge in the cylinder that lags 90 degrees. When the crossfire touches them off, the piston is so far from top center it wants to kick back the other way."

Ted snapped his fingers. "I've got it. Two cylinders are fighting the rest of the engine. You moved the wires apart?"

"As easy as that," Gus said.

"Now, one more problem," Ted said. "How am I going to explain this magic fix to the guys at the police garage?"

"Tell you what," said Gus. "Put a few drops of water in the fuel-pump filter bowl. They'll be sure to spot it and think they've found your trouble."

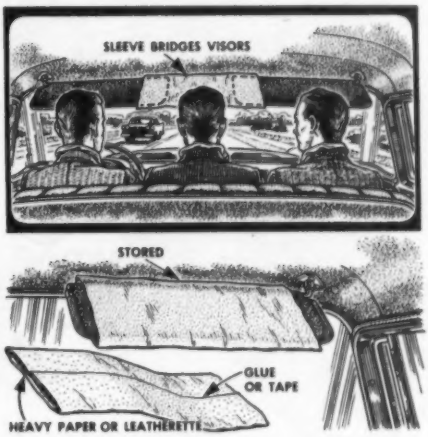
Ted chuckled. "I've heard of oil on troubled waters, but that's a new twist."

"Well, Ted, if you're going in for bucking city politicians, you'd better learn a few tricks of your own." END

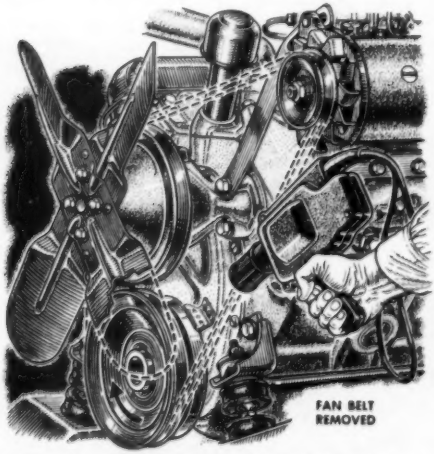
***Next month: Gus faces a lawsuit.***

# Hints from the Model Garage

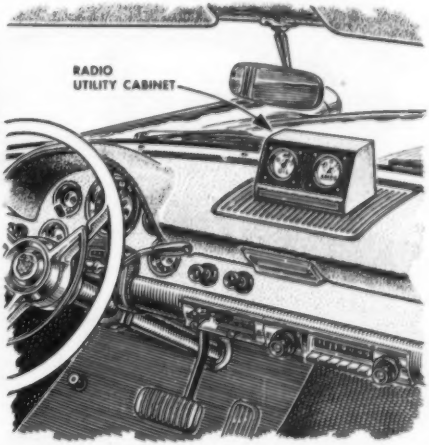
**Rattles can be silenced** where metal vibrates against metal, as often with license plates, by flowing a bit of liquid rubber between the offending parts. The rubber can be molded into an invisible cushion that remains soft after it dries.




**To close the gap** between sun visors, make a sleeve of heavy paper or imitation leather. For full shade across the car, put both visors down and connect them with the sleeve. When not in use, the sleeve can be stored on one visor.

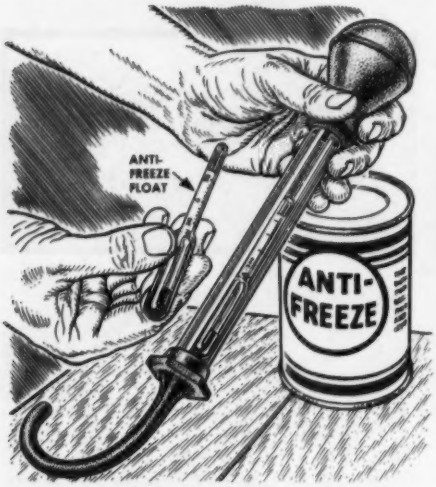



**Take the hazard out of timing** the ignition by removing the fan belt before tuning up. The engine will idle the same without it, and you can safely reach down with the timing light to pinpoint the degree marks on the vibration damper.

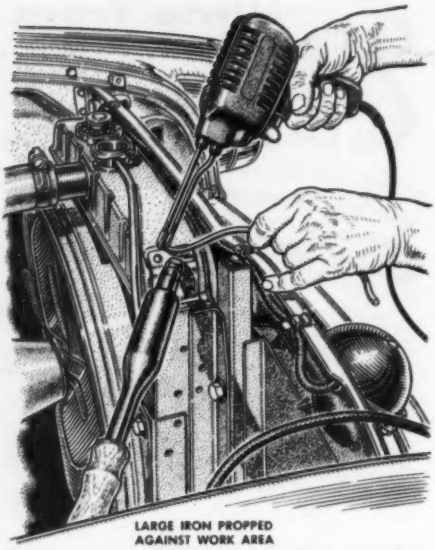



**Extra meters** can be installed without cutting the dash. House them in a radio utility box on top—where the speaker grille is often found. If you want to remove them, the grille can be cheaply replaced, leaving no holes in the dash.

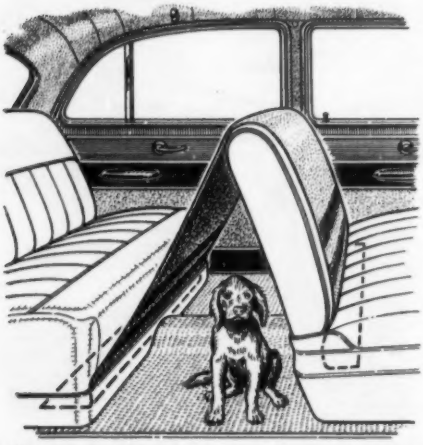
## More Hints from the Model Garage



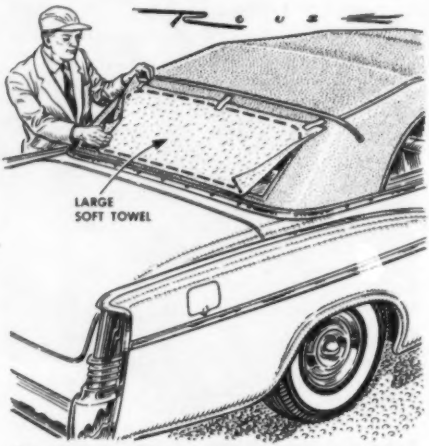

**A hydrometer can do double duty** if you buy a second float calibrated for antifreeze. Remove the tip of the tester to install the proper float for checking the battery or the antifreeze. Rinse the hydrometer with clear water after each use.




**Concentrate extra heat** into an area that's difficult to solder by propping the tip of a large iron against the spot while you do the actual soldering with a second iron or a gun. Drain out the coolant when working on a radiator or heater.



**You can keep the dog from jumping** over the car upholstery by confining him under a blanket stretched from the front seat to the back. Raise the back seat and tuck the blanket under it, then drape it over the front to make a tent.




**Protecting the rear window** of a convertible from scratches, caused by dust and grit when the top is lowered, is easy with a towel. Hang it from short strips of tape, and see that it rests flat on the plastic as it folds into the well.

Hi-Fi and Electronics

# Hi-Fi Buyer's Guide: Record Changers

GLASER-STEERS

V-M

GARRARD

MONARCH

***Changers are used in most hi-fi systems, but can they really deliver high fidelity?***

**By R. S. Lanier**

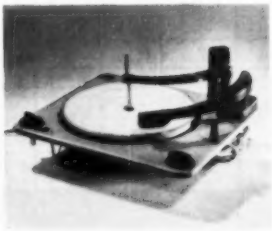
IS THE record changer going to stay alive in the stereo age? Answer: Yes. Most manufacturers, in fact, have already modified their changers to take the stereo record.

The ultra-pure hi-fiers will probably remain unmoved by this. They have always avoided changers, even with monophonic records, in favor of the expensive professional turntable and separate pickup arm.

But for many years most buyers of hi-fi systems have chosen the changer. Package hi-fi, now getting hundreds of millions of the public's dollars every year, is 100-percent changer. To be so lusty in the market, the changer has had to give value.

POPULAR SCIENCE has surveyed the latest crop of changers. The manufacturers' answers to our questions give you a fact-filled X-ray of each one. Adding instru-

WEBCOR



COLLARO

MIRACORD

**RECORD-CHANGER KIT** (by Heath) comes with much of the basic mechanism, including the tone arm, assembled on the chassis. The remaining assembly requires little mechanical skill.

**FINISHED CHANGER** is top quality. Parts for the wooden base are included. The instruction manual is easy to follow and has an excellent, detailed section on trouble-shooting.

# Facts and Figures About

| MANUFACTURER | MODEL | APPROXIMATE PRICE (no pickup) | MINIMUM CABINET SPACE REQUIRED (inches) | | | | CHANGE INTERMIXED SIZES? | CLICK FILTER? | MUTING SWITCH? | VARIABLE SPEED CONTROL? | FULL MANUAL POSITION? | SHORT CENTER SPINDLE PROVIDED? | DOES IDLER DISENGAGE AUTOMATICALLY? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Width | Length | Above Deck | Below Deck | | | | | | | |
| AUDIOGERSH | Miracord XS-200 | $67.50 | 10¼ | 12½ | 2½ | 2¾ | yes | yes | yes | no | yes | yes | no |
| COLLARO | TSC-640<br>TSC-740<br>TSC-840 | $38.50<br>$42.50<br>$49.50 | 12 | 13½ | 5 | 2¾ | yes | yes | yes | no | yes | no | yes |
| DISCUS | Monarch UA-8 | $37.20 | 10¾ | 12⅝ | 5 13/16 | 2½ | yes | no | no | no | no | no | no |
| | Monarch UA-12 | n.a. | 11¼ | 13⅛ | 4 13/16 | 2½ | yes | yes | no | no | no | no | yes |
| DUAL | Dual 1006 | $67.50 | 10¾ | 13 | 6 | 3 | yes | no | yes | no | yes | yes | yes |
| GARRARD | RC-121/II | $42.50 | 13 | 14½ | 5 | 3⅛ | yes | yes | no | no | yes | no | yes |
| | RC-88 | $54.50 | 13¼ | 15½ | 5¾ | 3⅞ | no | yes | yes | no | yes | yes | yes |
| | RC-98 | $67.50 | 13¼ | 15½ | 5¾ | 3⅞ | no | yes | yes | yes | yes | yes | yes |
| GLASER-STEERS | GS-77 | $59.50 | 12 | 13½ | 5½ | 3 | yes | yes | yes | no | yes | no | yes |
| HEATH | RP-3 | $64.95[a] | 12 | 13½ | 5 | 3 | yes | yes | yes | no | yes | no | yes |
| V-M | 1201<br>1202 | $40.00[b]<br>$40.00 | 12 | 13¼ | 5 11/16 | 2⅝ | yes | no | yes | no | yes | no | yes |
| WEBCOR | Imperial TR-1931 | $44.10 | 13½ | 14¾ | 5½ | 4 | yes | yes | no | no | yes | no | yes |

[a] Information not available; [b] available only as a kit, complete with GE VR2 pickup; [c] with stereo cartridge.

ment and listening tests, we discovered that:

- All the changers checked did a satisfactory job of changing records automatically.
- They all have four speeds, which means you pay for two speeds you'll probably never use.
- For $55 to $60 (without pickup), you can get a changer that in our opinion does a genuine hi-fi job in playing both standard and stereo records.
- In the $40-to-$50 range are a number that do an acceptable job of playing standard LPs. Most of them, however, fall short of high-quality stereo.
- In any price range, it pays to check the particular unit before you buy. Because of manufacturing variations, even the best designs occasionally come up with a lemon; and you can sometimes find a better-than-average unit among the less expensive ones.

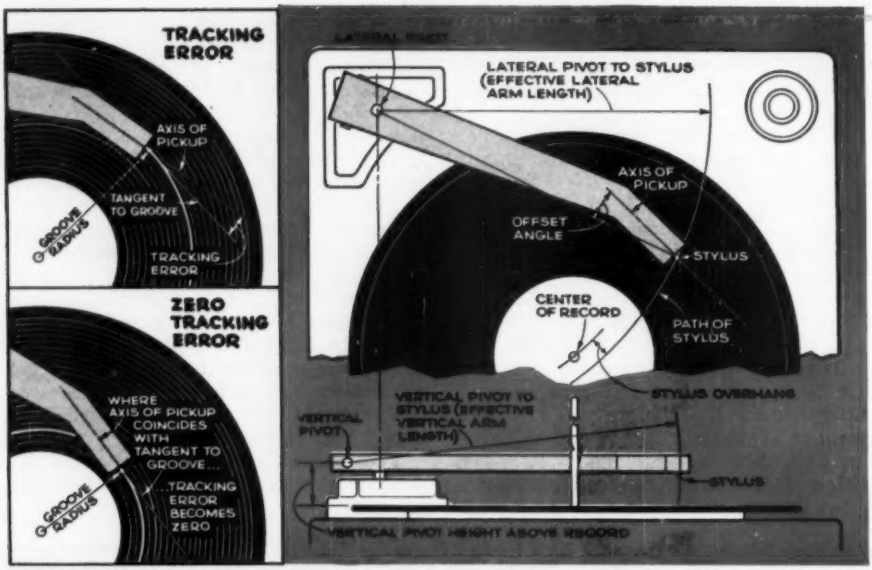
***The compactness of a changer***, one of the things buyers like most, keeps designers from using an arm that is long enough, and with the right geometry, for ultimate quality. The pivot for vertical motion must be fairly high, to allow room for the records to pile up on the turntable. This makes the arm angle downward sharply when a single record is being played.

But the downward-slanting arm is hard on fidelity. On a warped record (how many of yours are perfectly flat?) the stylus moves a little forward and back as it goes up and down, creating some wow. On stereo records, the cartridge should be parallel to the record for lowest distortion.

The longer the arm and the closer the vertical pivot is to the record surface, the

## Popular Record Changers

| | Duration of Change Cycle (seconds) | Turntable | | Motor | | Tone Arm | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Weight | Outside Diameter (inches) | Power (watts) | Type | Lateral Length (inches) | Vertical Pivot Length (inches) | Overhang, Turntable Surface (inches) | Overhang, Full Stack of Records (inches) | Offset Angle (degrees) | Weight of Vertical Pivot | Wired for Stereo? | Interchangeable Pickup Mounts? | Minimum Tracking Force to Trip Changer (grams) | Range of Tracking-Force Adjustment (grams) |
| | 12 | 4 lb., 8 oz. | 10 | 15 | 4-pole | 7⅝ | 7⅝ | ⅜ | ⅜ | 23.5 | ⅞ | yes | yes | 4 | 4 to 9 |
| | 8 | 1 lb., 14 oz. | 9½ | 12 | 4-pole | 7⅝ | 7⅝ | ⅛ | 3/16 | 10 | 1¼ | no<br>yes<br>yes | no<br>yes<br>yes | 3½ | –11 to 12 |
| | 7 | 2 lb., 8 oz. | 9 | n.a. | 4-pole<br>2-pole | 6¾<br>7⅛ | 7¾ | n.a. | n.a. | 27 | 1¼ | yes | no | n.a. | 4 to 9 |
| | 10 | 4 lb. | 10¾ | n.a. | 4-pole | 7¾ | 8½ | 0 | 0 | 10 | 1 21/64 | yes | yes | 2 | 2 to 9 |
| | 5<br>4.6<br>4.6 | 2 lb.<br>2 lb.<br>2 lb. | 10<br>10<br>10 | 10<br>16<br>16 | 4-pole | 7½ | 8¼ | 7/16 | ½ | 26 | 1.0<br>⅞<br>⅞ | yes | yes | 2 | 0 to 20 |
| | 9 | 1 lb., 12 oz. | 9 | 12 | 4-pole | 7 7/16 | 7 7/16 | 37/64 | 21/32 | 24 | 31/32 | yes | yes | 3 | –25 to 20 |
| | 9 | 1 lb., 8 oz. | 9 | n.a. | 4-pole | 7½ | 7½ | n.a. | n.a. | 24 | ¾ | no | yes | 2 | –25 to 20 |
| | 10 | 1 lb., 6 oz. | 9 | 28<br>30 | 2-pole<br>4-pole | 7 3/32 | 8 3/32 | ½ | 19/32 | 22 | 1⅜ | yes | no | 4 | 0 to 14<br>¼ to 18 |
| | n.a. | 1 lb., 7½ oz. | 9 | 18 | 4-pole | 7 7/16 | 7 7/16 | 3/16 | 7/64 | 18 | 3/64 | yes | yes | 5 | 0 to 60 |




**PERFECT TRACKING** requires the axis of the pickup to be tangent to the record groove at every point. No pivoted arm can do this exactly, but the error is less with a long arm. Tracking of shorter arms is improved by offsetting the pickup and arranging for the stylus to overhang the turntable center. Compact design of changers does not allow room for optimum solutions. High vertical pivot needed to clear a stack of records on the turntable also makes problems.

less trouble you'll have on this score. You can improve the performance of any changer by using enough record pads under a single record to make the tone arm level in the playing position.

***Tracking error*** is another problem. This is the failure of the tone arm to hold the pickup so that its axis is tangent to the record groove at all points on the record. Putting a bend in the arm and mounting it so that the stylus overhangs the turntable center reduces this error. The exact amount of bend and overhang needed for optimum results can be calculated from the geometry of the arm and record. None of the units we checked had enough bend for the theoretical optimum for 12″ LPs. But several were close enough so that you would never be aware of the distortion.

In theory, the optimum 7½-inch arm would have an offset angle of around 29 degrees if you were going to play only 12″ LPs. The longer the arm, the less offset needed. The best compromise for playing all sizes is closer to 26 degrees.

The traditional and evidently unbreakable price slot of the changer prevents all-out, nothing-barred attack on the main enemies to your listening pleasure: rumble (low-pitched noise from table vibration) and wow and flutter (distortion of the music by changes in table speed). It costs plenty to get all three to the vanishing point. The stereo pickup with its high sensitivity to rumble puts still more squeeze on the changer designer.

So it's pleasant to report that we found several units with rumble well below an acceptable level. With these, even stereo will not be affected.

We checked with stereo pickups installed, with the volume set just a shade above normal listening level, and with bass normal. (Volume beyond this point, or excessive bass boost, will make the rumble obtrusive with any turntable.)

Our speaker system was flat to about 55-60 cycles per second with substantial output down to 30 c.p.s.—as good as, or better than 90 percent of all hi-fi speakers. For your own rumble test, use the same type pickup, amplifier and speaker that you will use at home.

***Wow***, the over-the-waves effect you hear when turntable speed wavers up and

# INSIDE STORY of the mighty Sea-Horse V-50!

**ADVANCED ENGINEERING AND DYNAUTICAL DESIGN SHOW WHY JOHNSON LEADS IN BIG MOTORS**

## Inherently balanced "V" design

A firing impulse every 90° gives smooth flow of power with minimum vibration. Note how the compact "V" design allows the crankshaft to be rigid, short and strong.

## Synchro-setting carburetor

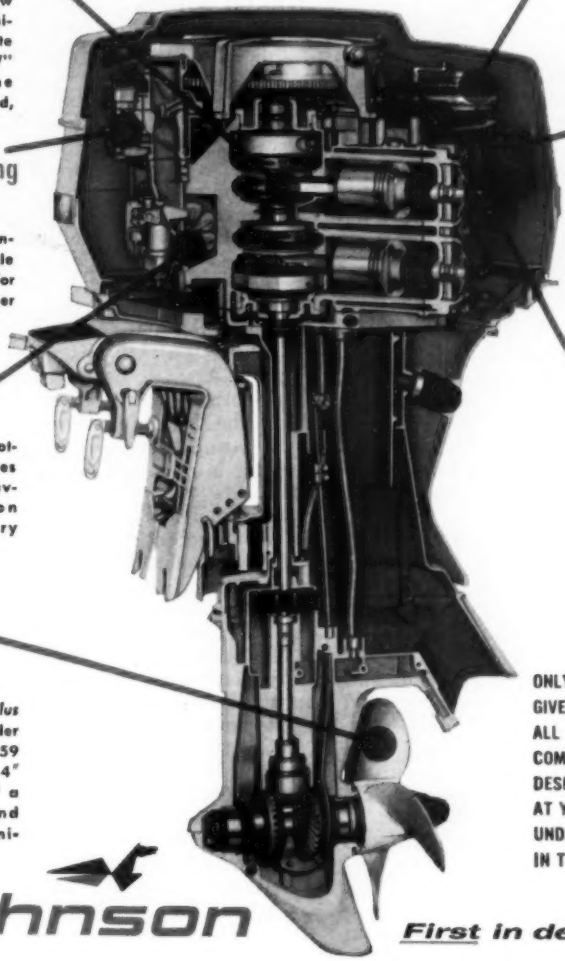
Twin barrels are simple to set with a single synchronized lever for high speed — another for slow speed.

## Automatic fuel-saver

A cruising range throttle linkage that gives up to 20% in fuel savings. One gallon saved out of every five!

## New propeller design

For greater speed *plus* plenty of power under load, the V-50 for '59 carries a 12" x 14" prop. It's made of a new, stronger and more ductile aluminum alloy.



## New electric starting motor

This is a more powerful unit, yet it actually uses less battery current than previous motors.

## High output magneto

This distributor-type magneto (Johnson's own design) is easily accessible for service. It's mounted on special anti-friction bearings.

## Thermostat-controlled cooling

For smoother running and less engine wear, cooling system water is recirculated and kept between 130° and 150° F. — regardless of outside water temperature.

ONLY A V-50 SEA-HORSE GIVES YOU SO MUCH— ALL THESE FEATURES COMBINED IN DYNAUTICAL DESIGN. SEE IT NOW AT YOUR DEALER LISTED UNDER "OUTBOARD MOTORS" IN THE YELLOW PAGES.

**Johnson**

***First in dependability***

down during each revolution, is the most annoying of all turntable defects. There is no way to mask it. Unlike rumble, for example, it is just as objectionable with the tiny speaker in a cheap record player as it is with the finest hi-fi system.

The best listening test for wow is very slow piano music. You won't need to be told what to listen for; if the defect is present, it will be painfully evident. This is the one shortcoming that should rule out a changer for even the most economical playing equipment.

Among the less expensive changers, the Webcor was outstanding for very low wow and flutter.

***Flutter,*** which is very fast wow, is hard to disentangle from other forms of distortion by ear. If the music is noticeably less clear on changer A than changer B, with the same recording, pickup, amplifier and speaker, the first can be suspected of a higher flutter level.

Among the units that do a good job with monophonic records and won't disappoint you on your stereo records, the Audiogersh Miracord XS-200 has easy pushbutton operation. The Garrard RC88 continues to uphold a fine reputation for excellent tracking and low rumble.

A new American changer, the Glaser-Steers GS-77, has original and excellent mechanical design. Among other innovations, the record does not turn during the change cycle. And we have our first record-changer kit for home assembly: The Heath RP-3 makes up into an excellent changer with fairly short effort by the buyer.

How do these top changers compare with the hi-fi fan's professional turntable? Instrument tests brought out clear differences, of course—the pro table we used costs more than twice as much as any changer.

But it's the listening comparison that counts. Using identical stereo pickups and records, with volume turned up so rumble was clearly audible, we found the best changers just noticeably more rumbly than the pro turntable. But with volume normal, rumble was not troublesome.

Wow and flutter were just a shade higher on the changers, but it took careful, repeated back-and-forth comparisons to bring out the differences.

If you have a super speaker system strong all the way down to 30 cycles per second, you would probably find rumble annoying with any changer—and with many pro turntables, too, for that matter.

But 90 percent of hi-fi systems have speakers of far less splendor. Only the large systems in the several-hundred-dollar class make it honestly to anywhere near 30 c.p.s. Owners of such speakers usually buy a pro turntable, at far more than the cost of a changer.

The rest of us, with much smaller hi-fi budgets and less tremendous speakers, will be satisfied with top-quality changers. Our satisfaction will be more secure if we examine a changer for the following additional qualities:

***Stylus-force adjustment.*** Make sure you can adjust the stylus force to the right value with the cartridge you are going to use.

***Tripping mechanism.*** What happens when the stylus comes to the run-off groove at the end of a record? If the tripping mechanism is too stiff, the stylus will jump out of the groove each time the arm comes up against the tripper. Change cycles should be tripped without having to increase stylus force over that needed for normal playing.

***Orientation of cartridge and pivot.*** The cartridge must not "roll" from side to side as the arm rises on a stack of records. As little as three degrees away from horizontal, in the side direction, reduces the "separation" on stereo records.

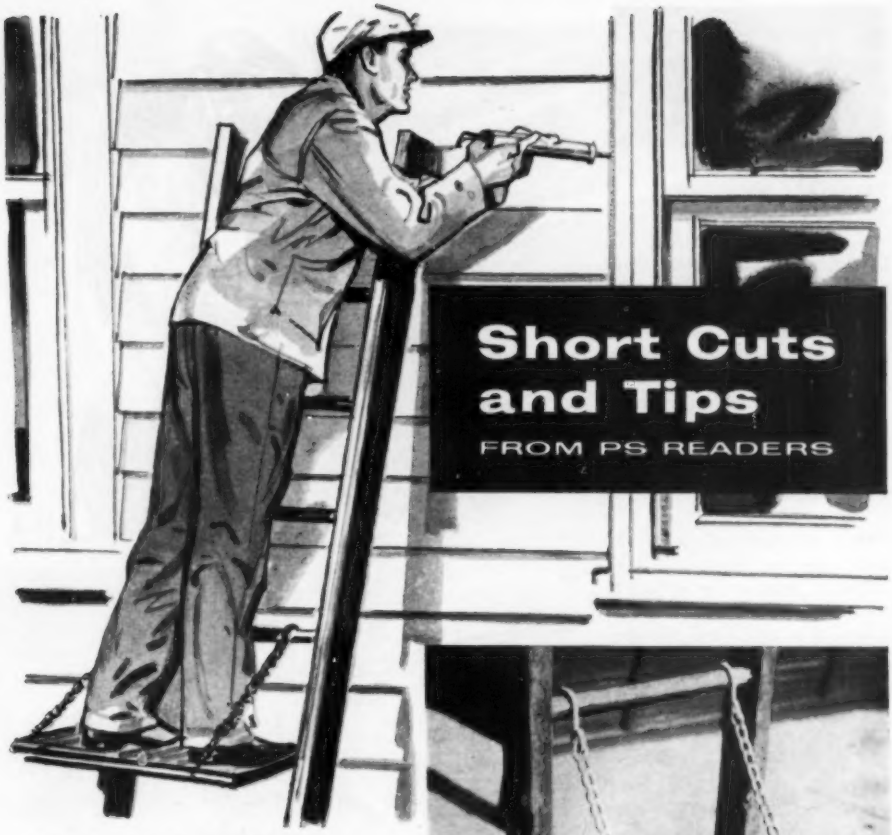
***Mounting.*** The springs on which the changer is mounted should let it bounce at a slow rate, almost slow enough to count. This makes the table insensitive to outside vibration in the audio range.

Garrard supplies an especially convenient and effective spring-suspension. Mounting screws level the changer without affecting the vibration isolation.

Now you know *how* to pick a changer. *Why* you buy a changer (rather than a turntable) is something else. Automation is the answer.

Want to stay in your chair through eight or 10 records, for an evening of uninterrupted background music? A changer lets you. Want automatic placement of the pickup on the record at the beginning, and removal at the end? A changer does these finicky jobs for you.

And the top changers will deliver hi-fi quality to all speakers except those that have a wallop in the lowest bass. END



# Short Cuts and Tips

FROM PS READERS

## Safety Platform Hooks on Rungs of Ladder

STANDING for hours on a ladder when you repair a gutter, point up brickwork, paint or calk windows can be hard on your feet.

This handy platform will take the strain off your arches, reduce the chance of an accident and leave both hands free.

Heat and shape hooks on the ends of two lengths of strap iron, and drill them and a 9″-by-13″ piece of heavy plywood for six bolts. You will also need two lengths of chain with hooks to fit over the next higher rung. Assemble with the two bolts on the outside of the platform run through a link in each chain to hold it level.—*Andrew Vena, Philadelphia.*

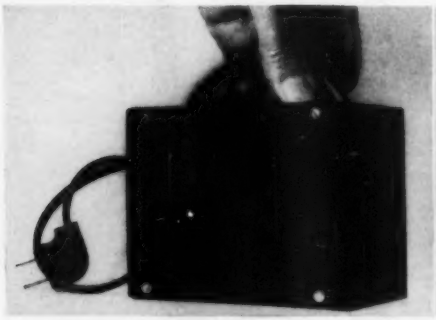
## Short Cuts and Tips

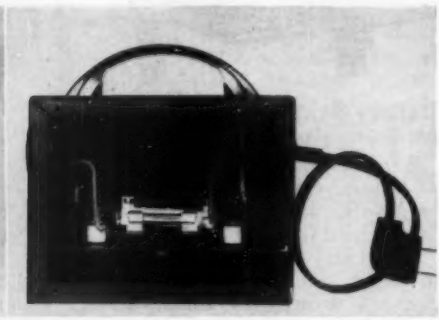
### Multiple Driving of Wood Screws

WHEN an automatic push drill isn't readily available and I have a large number of screws to put in, I use a socket wrench.

Selecting a size for a snug fit, I insert an ordinary screwdriver with a ribbed plastic or wood handle and set the socket wrench for ratchet drive.—*R. S. Pugh, Reynoldsburg, Ohio.*

▶▶▶A SCREEN-DOOR hook and screw eye lock my ladder so it won't open when I am carrying it to a job. They are attached to the legs just below the folding brace.—*Jerome A. Cunningham, Philadelphia.*





### Protection for TV Tubes

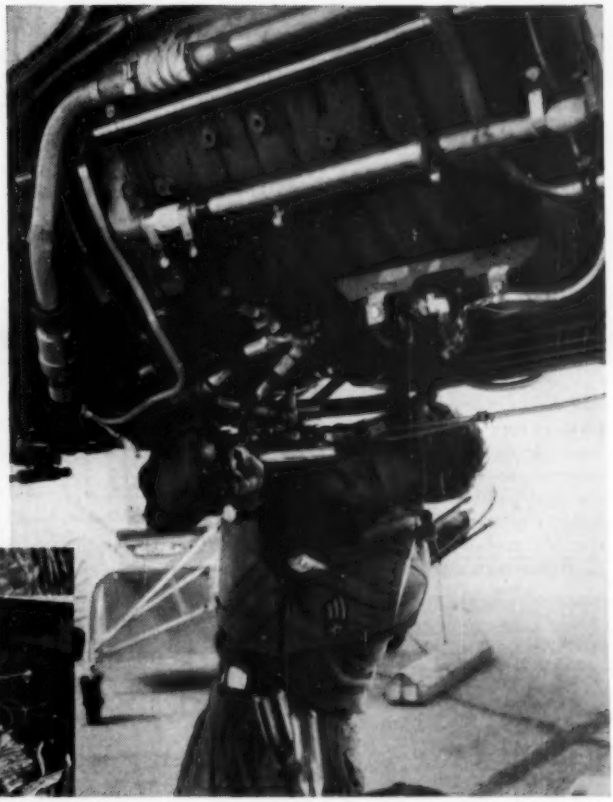
THE instant you switch your TV set on, a terrific surge of current flashes through the filaments of all the tubes, shortening their life. This is because the resistance of a cold filament is a great deal lower than that of a hot one.

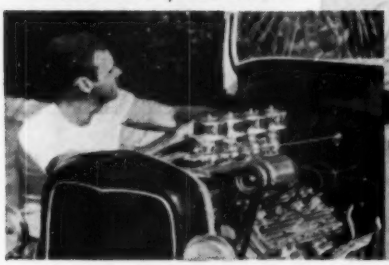
I plug an automatic resistance into the circuit of my set. The one I am using provides a maximum of 100 ohms for about 11 seconds and then is reduced to 0.2 ohm. The unit is called a Surgistor and sells for about $1.50.

Instead of mounting this uninsulated part inside the TV cabinet, I placed it on two porcelain insulators inside a 3″-by-4″-by-5″ metal cabinet and wired it in series with a two-amp fuse to care for my set's 175-watt power demand. Through rubber grommets in the ends, I inserted extension cords, one with a plug and the other a standard socket receptacle.—*George P. Pearce, Albuquerque, N.M.*

MEN OF MECHANICAL ABILITY:

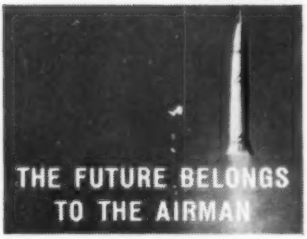
# YOU CAN BE A VALUABLE MAN IN THE NEW AGE OF SPACE





# TRAIN IN THE U.S. AIR FORCE

As a man of mechanical ability, you face a future of unlimited opportunity. This is the Age of Space, and *the valuable man is the man who combines mechanical ability with sound training.* Where can *you* best get this training? In the U. S. Air Force—where the Age of Space is *reality.* Here, Airmen work, day to day, in actual Space Age specialties: rocketry, supersonic aircraft, advanced electronics—and soon: manned flight in outer space. In short, the Air Force offers you the broadest, most complete range of Space Age specialty training available today. For details, see your local Air Force Recruiter, or mail the coupon.

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Airman Information, Dept. PS-10321
Box 7608, Washington 4, D. C.

Please send me information on my opportunities in the U. S. Air Force. I am between the ages of 17-34 and reside in U. S. A. or possessions.

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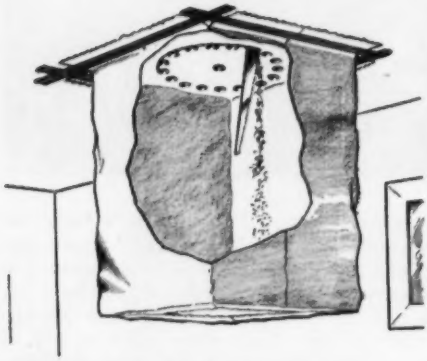
## Short Cuts and Tips

### Safety Latch for Basement Door

A CHAIN latch set out of reach of tots may prove a needed safety measure in your home. Install both pieces vertically, instead of horizontally, and you need not fear being locked out: It can be opened from either side of the door.—*Lucien Huot, Ste. Genevieve, Quebec.*

▶▶▶A RECORD album is a convenient holder for a selection of sandpaper. If you use one that's made up of four envelopes, each will hold several sheets of the four popular grades of paper. The holes in the center will show at a glance the texture of the sheets inside.—*Martin R. Bradstreet, Battle Creek, Mich.*

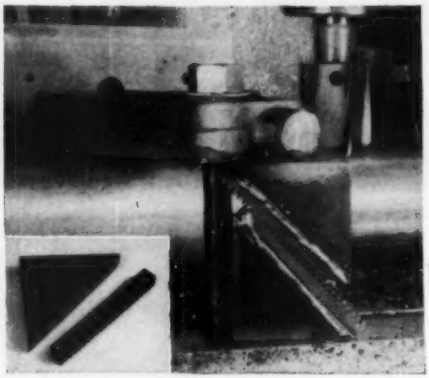


### Catcher for Falling Plaster

A PAPER bag taped to the ceiling will keep falling plaster off rugs and furniture when you cut through from the attic to install a light fixture.

Drill a tiny hole first and center the bag over it, holding it to the ceiling with masking tape. Then drill a series of closely spaced 1/4″ holes to outline the ceiling outlet box. Join the holes with a keyhole saw to complete the opening.

Plaster dust and the cut-out chunk of plaster will drop neatly into the bag, which can then be taken down and disposed of.—*Ernest Reinmuller, Troy, Ohio.*



### Step Blocks for Holding Clamp

You will find these two adjustable step blocks useful for blocking up the heel of a hold-down clamp on a machine-tool table. The blocks are made of two mating halves, each a 45-degree triangle bandsawed from 1/2″ steel plate. Weld a short length of steel gear rack to the long side of each. Then by meshing the racks together at any desired point, the height may be adjusted to suit the job.

Standard gear-rack material is a stock item with many gear manufacturers, or a suitable piece may be picked up in a junk yard.—*H. J. Gerber, Stillwater, Okla.*

*What kind of a car do you want, exactly? Chevrolet has a choice of nine engines, five transmissions, two suspension systems, regular or Positraction rear axles, special cams, two air-conditioning systems, even Fuel Injection—the list of extra-cost options is tremendous. But what it means is that you can virtually design your own car, tailored precisely to your needs. Here's just one example:*

# "I 'built' my Chevy for top economy... and extra easy running at 300 miles a day."

"As a traveling salesman with a big Midwest territory I rack off about 300 miles a day—and, boy, how I love gas economy. But I like all the comfort I can get, too.

"I used to wish I could design my own car, until this year. That's when my on-the-ball dealer friend showed me how I could 'build' just the right car out of Chevy's terrific list of options. Look what I got:

"I picked a Biscayne two-door, 'cause I pay for my own auto and that's right at the base of the price list. A Hi-Thrift 6 engine—that's the world's best workhorse. And Overdrive; with that high ratio you can just whisper down the road at good fast cruising speeds. No strain, hour after hour . . . and that gas needle *never* seems to go down!

"Then I pampered myself a little bit. Foam rubber padding in the seats (I'm a big guy and I spend *hours* at the wheel); Chevy's new throttle-holder where you just set your cruising speed for those long straights and the car holds it while you rest your right foot; the big 'fresh-air' heater. Man, you should drive my car. It fits me like a glove!"

There's something to figure on, friends. Whatever kind of car you want—sports car, salesman's car, town car—you can "design" it for yourself. But check your Chevrolet dealer and see how you can suit yourself to a T. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

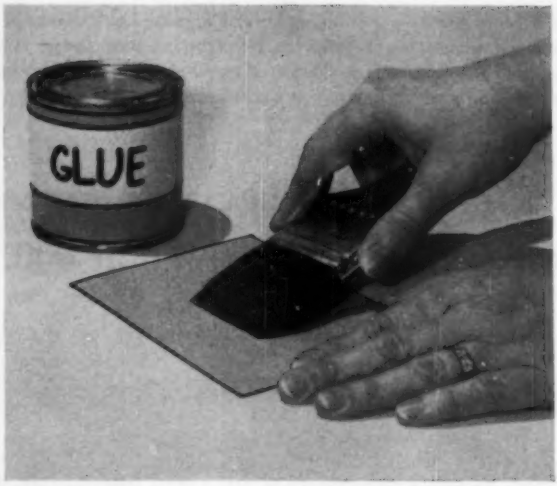
CHEVROLET

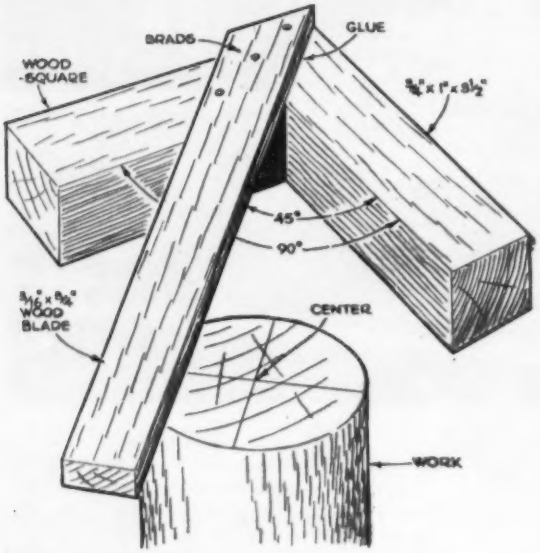
## Short Cuts and Tips

### Paintbrush Bevel Easy to Restore

You can give an old paintbrush a new bevel, or shape the end of an inexpensive brush, with water-soluble glue and sandpaper.

Dip the brush in the glue and let the bristles harden. Then shape the resulting block on sandpaper and wash out the glue.—*Frank Jacobson, Newark, N.J.*




### Quick Center Finder for Round Stock

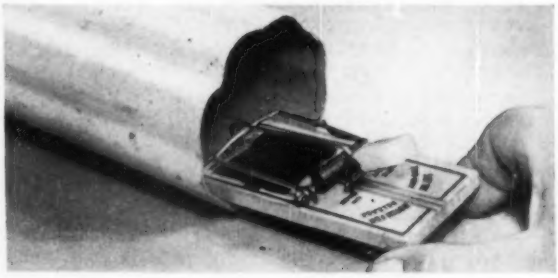
You can find the center of round stock up to 4" in diameter with this simple device. Use it for marking material to be mounted for turning in the lathe, legs to be drilled for casters, and similar work.

Make the centering tool from hardwood, forming a right angle with a mitered or other precise joint. The front or marking edge of the blade must be exactly 45 degrees from the two arms of the right angle.

To use it, draw two lines along the blade on the round stock; they cross at the center.—*Harold Jackson, Kankakee, Ill.*

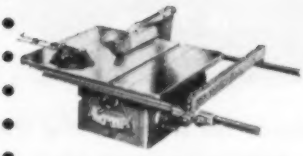
### Simple Guard Makes Mousetrap Safe

A mousetrap can be made safe for your children, pets and livestock by setting it in a short length of drainpipe hacksawed from a discarded section. You can crimp one end to close off one opening.—*Bil Toman, Palatine, Ill.*

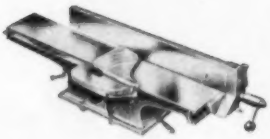


10" Sand Saw

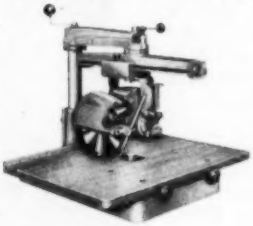
Delta Shop—combines Saw, Jointer, Drill Press, Sander.



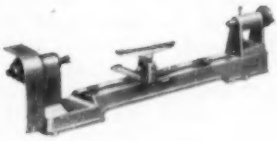
9" Tilting Arbor Circular Saw



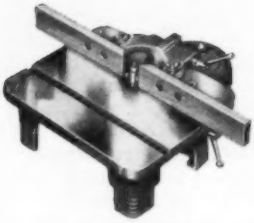
Deluxe 4" Jointer



"Super 900" Radial Saw

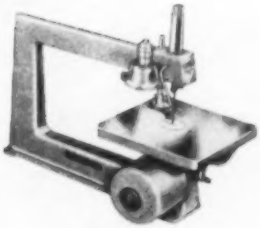


14/11 Lathe



Heavy Duty Shaper

11" Drill Press



16" Scroll Saw

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## Short Cuts and Tips

### Dolly for Moving Big Panels

USING a hardwood block fitted with a caster and two strips of sheet steel, you can move large panels of wallboard, wood and other materials without help.

Bend the steel pieces so they form a clip when screwed to the sides of the block. In use, slip the clip over the lower edge of the panel near the center—and push.—*M. R. Beasley, Jackson, Mich.*

▶▶▶FIBER washers used in faucets also make good spacers, insulators and the like on many electric and electronic jobs. —*Carleton A. Phillips, Corning, N. Y.*

### Rubber Balls Anchor Plastic

TRY using rubber balls when you attach tie lines to plastic tarpaulins or other material that lacks strength to hold a grommet. Wrap a corner or a section of the edge around the ball and tie the line to it. Use a soft ball for the job—it's less likely to tear the material.—*R. Mathiot, Lake Grove, Ore.*

### Easy Way to Dress a Grinding Wheel

WHEN a grinding wheel becomes glazed, filled with soft metal, or worn slightly out of true, use it to sharpen a tungsten-carbide masonry bit.

If you hold the bit firmly on the tool rest, the hard tip will take off enough of the surface for the wheel to be dressed by the time it is sharpened. Be sure to wear glasses to protect your eyes.—*John Burroughs, Tacoma, Wash.*

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## MORE FOR YOUR MONEY

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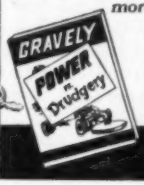


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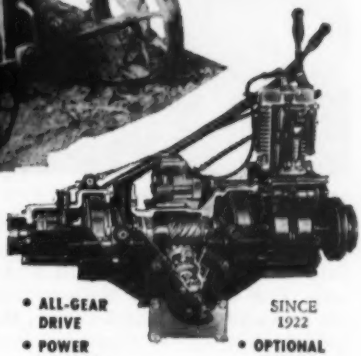

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## Short Cuts and Tips

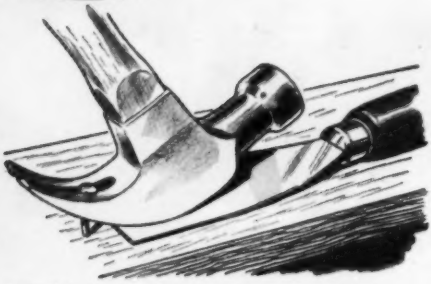
### No Funnel Handy? Try a Flowerpot

A FLOWERPOT makes a good emergency funnel for pouring liquids into an open-top container. All you need to do is set the pot over the container opening and pour.—*Harold R. Terpeny, Marion, Mass.*

▶▶▶SEVERAL finishing nails driven into a foot-long strip of wood mounted near your workbench will hold a variety of sizes of small nuts and be handy for any job. Mark by each nail the size you intend to store on it.—*William B. Goodrich Jr., Somerville, Mass.*

### How to Saw Corners

EVEN such a simple woodworking operation as sawing off the corner of a board with a handsaw has a right and wrong way. The wrong way risks splitting the corner at the point marked "X"; the right way doesn't.—*C. C. Cooley, Detroit.*



### Putty Knife Helps Pull Nails

WHEN I have to pull a nail with a claw hammer and don't want the finish marred, I slip the blade of a putty knife under the head. As I rock the hammer back, the blade shields the surface from dents.—*Joseph A. Carroll, Pittsburgh.*

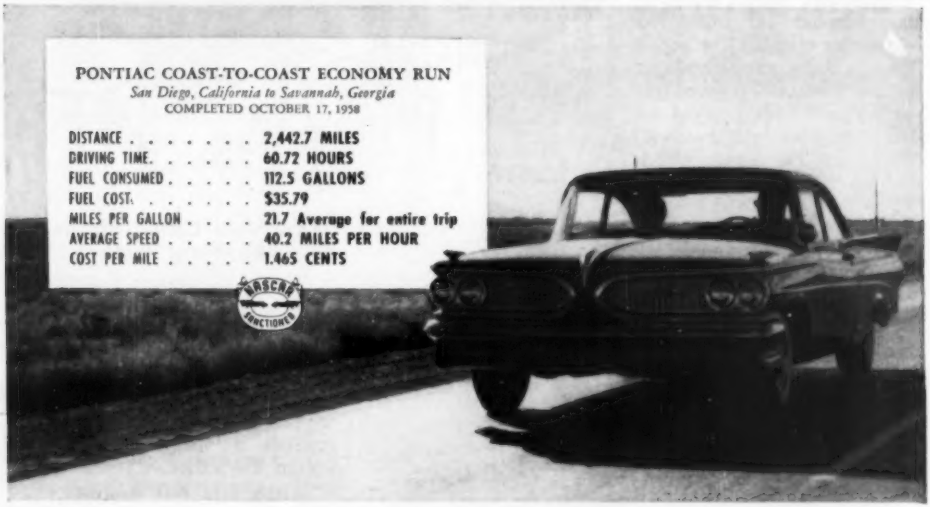
### Checking Micrometer Setting

I USE a steel bearing ball for checking the accuracy of my micrometer setting. It is more satisfactory than running the spindle down on the anvil since it checks the screw at a midway point where the instrument is most often used.

Lapped high-carbon chrome steel balls are available in tolerance ranges of millionths of an inch. They have a surface finish equal to that of precision gauge blocks.—*Henry Gaines, Tulsa, Okla.*

# COAST TO COAST ONLY 1½ CENTS PER MILE FOR GAS!

## Pontiac's new Tempest 420E V-8 sets the year's most important economy mark—Here's the story and what it means to you!



We asked one of America's most respected car testers—"Uncle Tom" McCahill—to put a standard Pontiac Catalina Sedan with our new economy V-8 to the test.

And with only one specification—that the run would be exactly like *you* would drive coast to coast yourself—in mountains, in city traffic, across deserts, buying gas wherever the tank ran low.

And here's the phenomenal story in every complete detail—all officially certified by NASCAR, America's top automobile competition authority.

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If you owned a Pontiac with this new Tempest 420E V-8 you'd be saving up to 5 cents a gallon on regular fuel. This remarkable new economy V-8 is optional at no extra cost on any Pontiac!

See your Pontiac dealer soon—and discover the newest in V-8 performance and economy!

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## Short Cuts and Tips

### Old Valves Make Hooks on Wall

OLD automobile valves, driven into small holes drilled at an angle in our garage-wall studs, serve as large hooks on which to store tire chains, tow ropes and other miscellaneous gear. The large heads of the valves make them ideal as hangers.—*John A. Comstock, Wellsboro, Pa.*

### How You Can Soften Dry Masking Tape

WHEN an unused roll of photographic masking tape becomes dried out, it is difficult to unroll without tearing. You can remove a strip in one piece by holding the outside of the roll against a warm iron to soften the adhesive.

When you put it away, store in a metal box with moistened blotting paper to avoid having to repeat the process next time.—*Ken Murray, Colon, Mich.*

### Mitering Rubber and Plastic Baseboard

CUTTING close-fitting mitered joints in rubber or vinyl baseboard molding with a knife takes considerable patience.

It is easier to use your table saw. But be sure to push the molding into the blade slowly in order to avoid stretching it out of square, and use a sharp blade that will make a clean cut.—*James Browning, Seattle, Wash.*

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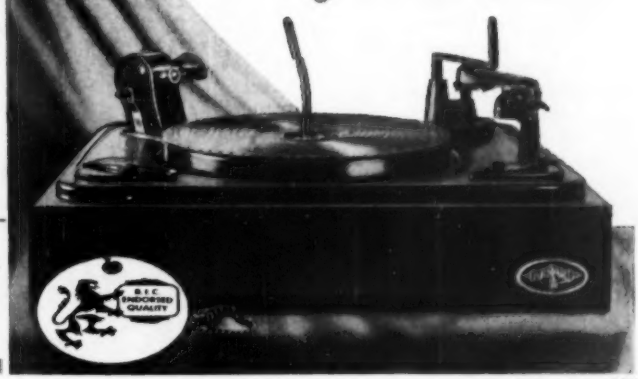
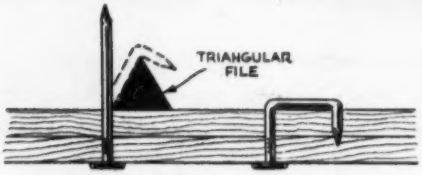


## Short Cuts and Tips

### Photo-Spotting on Small Work

This one-hair spotting brush is easy to use on small dots and hair lines. Its single hair requires no "pointing" and you are less likely to overlap the area being spotted.

Pluck a stiff bristle from a clothes brush or the like and cement or tape it to a toothpick. To make using the photo-spotting fluid easier, slit 1/8" of the end of the bristle with a razor blade.—*R. E. MacAndrews, Portland, Me.*




### Clinching Nails in Thin Wood

THE best way to nail two thin pieces of wood together is with clinched box nails. After driving the nails, bend them over a triangular file to clinch neatly. This also helps draw the pieces tightly together.—*Nils E. Mockler, Putnam Valley, N. Y.*

### How to Make Good Rubber Toy Wheels

SMALL wheels for toys and repair jobs are a problem. When the kindergarten sent eight damaged trucks to our school shop, I used the rubber wringer from an old washer.

I cut the wringer in two, chucked the shank in a lathe, faced the end and centerdrilled for axles. With a cutoff tool, I turned the rubber to width and rounded and shaped with emery cloth. Then I cut the wheels apart.—*George S. Gardiner, Punxsutawney, Pa.*

# Table model becomes console with Western Pine Region Woods

Photo courtesy Furniture Industries Inc.
North Miami, Florida

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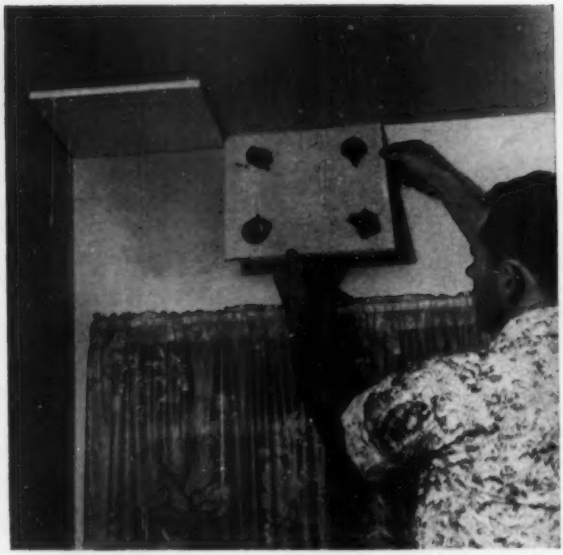
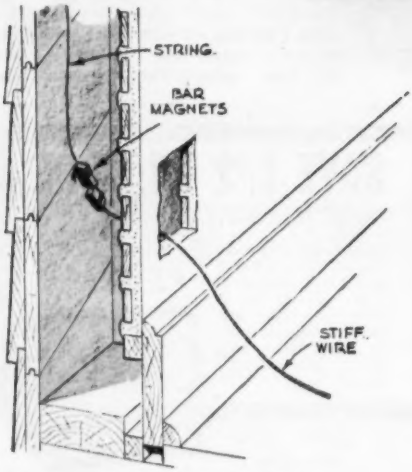
## Short Cuts and Tips

### Putting Up Ceiling Tile Without Nails

THERE is no need to nail up furring strips for acoustical tile and take a chance on loosening sections of plaster. You'll find it easier—and safer—to use one of the new powerful mastic adhesives.

Put a walnut-size lump about 2" from each corner and press in place. One gallon should do 60 to 80 square feet of ceiling.—*V. Lee Oertle, Azusa, Cal.*






### Wiring Between Walls

Two strong bar magnets are much more efficient for fishing wires between walls than the usual wire hooks.

Attach a string to the BX or other sheathed cable and tie the other end to one of the magnets. Drop it from the floor above and fish for it through the outlet hole with the other magnet taped to a piece of stiff wire.

When the two magnets make contact, you can pull the cord easily through the hole.—*Donald Crepeau, Jackson, Mich.*

### Shovel-Blade Shoe Scraper

THE blade of an old shovel imbedded upright in the ground makes a good shoe scraper for removing mud and snow. —*Jerome A. Cushman, Philadelphia.*

▶▶▶IF WASHING or painting cellar windows is a chore, replace the hinges with storm-sash hangers. They're as good as hinges when you hook the windows open, and in addition they let you take the windows off for special jobs.—*Charles McMurtrie, Dansville, N.Y.*

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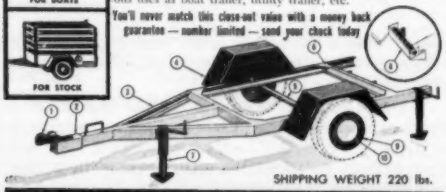

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(Advertisement)

# A New Pill That Helps You Quit Smoking

***Science at Last Tells You What to Do if You Want to Stop Smoking***

**By George Clark**

THE INABILITY to give up smoking is one of the more curious idiosyncrasies of 20th century man. Ever since Sir Francis Drake in 1586 brought tobacco back to England from Virginia and the habit of smoking was reimported to America by the Pilgrim fathers, the "noxious weed," as an eminent Victorian referred to it, has had half the world in its grip.

There are signs that this grip is at last being loosened. It is being loosened by a harmless little white pill. The story of how this little white pill was discovered is a curious one.

In 1947, doctors composing a research team at Chicago's Loyola University, set out to study gingivitis, a rather unpleasant inflammation of the gums that bedevils mankind. It had long been theorized that smoking contributed to this inflammation. But would stopping smoking help? In true scientific fashion our researchers decided that half of their patients should stop smoking to see if they showed any improvement over the other half.

But what could they give a patient that would help him to stop smoking quickly and easily? Up to that time medical experience showed that there was no easy, pleasant way to stop smoking. Years before, some experimental work had been reported with a drug called Lobeline Sulphate. This curbed the desire to smoke; but in doses large enough to be effective, it produced various unpleasant side effects. Here at least was a starting point.

Soon the tail was wagging the dog and the project of finding a way to help people conquer the tobacco habit had become the all-important problem. After months of research and experimentation, our scientists hit upon the solution. The addition of two common antacid ingredients to Lobeline Sulphate accomplished two things. First, any unpleasant side effects were eliminated; secondly, the amount of Lobeline Sulphate necessary to do an effective job was greatly reduced. The result was a harmless little white pill which, when given to test patients, enabled them to stop smoking in 5 days!

What made it work? Lobeline Sulphate is extracted from the Lobelia plant which is sometimes called "Indian Tobacco." It is a first cousin to nicotine, mimicking its action but without its harmful effects. It works by removing the craving for nicotine in the system and not by making smoking unpleasant or intolerable.

The footnote to this story is an interesting one. It turned out that smoking did irritate the gum tissues. Those gingivitis patients who, with the help of the little pill, stopped smoking, showed a marked improvement over the smoking half.

And of course there was a sequel. The university realized that in this little pill they had something that thousands longed for. Here was something that would really help anybody who wanted to free him or herself from the smoking habit. More research was carried on, more tests were made on hundreds and hundreds of patients. It was proved that 83%, more than 4 out of 5, of all people who wanted to stop smoking, could do so easily and pleasantly in five to seven days with the help of the little pills. Significantly, it was found that those who didn't stop completely had cut down their smoking drastically.

This new discovery was soon reported in medical journals; demand for it came overnight from every corner of the globe. The Campana Company of Batavia, Illinois, was chosen to market these amazing pills. Today you can buy them at any drug store in the United States, under the name of *Bantron*, for only $1.25 a box. They are also available in Canada. Bantron has been proven so safe, it can actually be bought without a doctor's prescription.

Of course, Bantron can't do *all* the work for you alone. It will not tie your hands behind your back. But if you really want to stop or cut down smoking, it can be a powerful helper.

As Capt. Roger Don Rae, a senior pilot for TWA, said: "I used to smoke all the time. I just couldn't stop. Then one day I heard about Bantron. With the help of Bantron, I stopped smoking in a few days. Today I am free of the habit."

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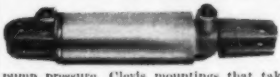

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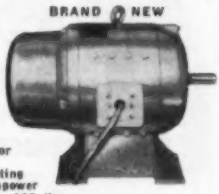

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## A Safety Expert Looks at the '59 Cars

[Continued from page 92]

***Accessories in the outfield.*** It shouldn't require many thousands of research dollars to discover the fallacy of locating controls or ash tray or glove compartment where the driver can barely reach them —or of designing such arty dials that a reading takes excessive concentration. The booby prize in this department goes to Mercury, with a clock now at the extreme right-hand corner of the dash. The safest way to tell the time on it is to stop the car, get out and look in the right-hand window! Both GM and Chrysler have incorporated their clocks in the instrument cluster, which is more sensible.

***Credits.*** Summing up some other aspects of the '59 cars, we can certainly give a round of applause to:

- Chrysler for their "self-dimming" rear-view mirror, which automatically depresses if struck by following headlights.

Their rather timid approach to an oval steering wheel also promises some hope for improving the cumbersome and obsolete wheels now current.

The entire Chrysler line's pushbutton controls for heater-air-defroster offer a welcome simplification of an operation heretofore too involved for a busy driver.

- Ford (and Edsel's) aluminized muffler for longer life is a needed advance. Not enough thought has been given to the relation between small carbon-monoxide leaks and the steady increase in sleepy-driver accidents on the superhighways.
- Mercury's windshield wipers, working in tandem to eliminate the center blind spot, deserve honorable mention.

With a lower cowl and the largest windshield in the field, the forward vision in this car is now excellent. Leg room in front is also fine, with the transmission hump reduced by moving the engine forward and canting it somewhat.

- General Motors can take bows for its relocation of the transmission quadrant on the instrument panel; and for its adoption of electric windshield wipers, long a Chrysler feature.

***Debits.*** On the other side of the ledger it is discouraging to find such a paucity of rear-seat leg room in Chrysler models below the Imperial. The feet, especially, are still pinned beneath the front-seat structure as in last year's models—a serious confinement in case of accident, es-

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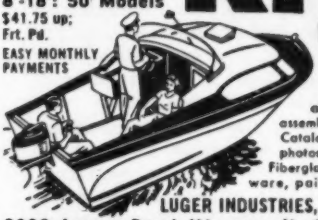

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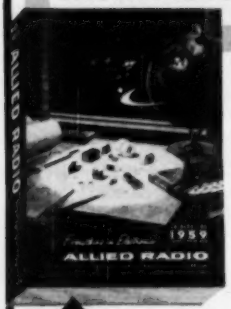


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pecially in a rollover. Believe it or not, there is as much leg room in the back of a Lark or a Rambler as in a Dodge or De Soto—practically as much as in a Mercedes-Benz or a two-door Cadillac. And you can get into or out of a Lark or a Rambler without knocking your hat off—or stumbling over the high rail that surrounds the deep well in all GM models.

Finally, in all except the Chrysler lines, rear-view mirrors are still inadequate, largely because of plunging roof lines. On the Rambler and the Lark, however, the postage-stamp size of the mirrors is a joke. More and more, the need for some adaptation of the periscope principle becomes apparent.

Safety design seems to be marking time in 1959. Genuine innovations are few; some truly basic things are still being ignored. The real problem is not so much that we have so many fatal accidents, but that we have so many survivable accidents in which people are needlessly killed.

More intelligent design is the answer. And this stark fact is making a deep impression on various legislators. Being lawmakers and enforcers, they instinctively feel that the surest remedy is governmental regulation.

***A safety program.*** Self-policing is much healthier than bureaucratic restrictions. So perhaps we should focus our hopes for improvement on the remarkable story of the Underwriters Laboratories and what they have done for product safety in electrical and other fields.

Why shouldn't the automobile insurance companies, who have so much at stake, set up a safety agency for cars comparable to UL? It might be under the auspices of the Society of Automotive Engineers—a much more logical group than the National Safety Council or the Bureau of Standards, both of which have already been formally suggested. It would issue an impartial label of approval that couldn't be bought for any price or influence, but would be available at cost when earned.

Lack of this label would soon be a thorn in the side of any Detroit sales manager. And if that lack would subject the manufacturer to a damage suit for injuries clearly attributable to inferior design, we would have truly crash-safe cars in jig time. END

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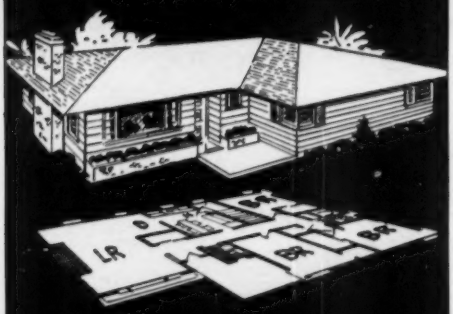


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***The Baffling Problem of Brake Fade***

[*Continued from page 109*]

perience shows that somewhat less lining length than the maximum that could be crammed inside a given drum usually works better. And, of course, the lining-area criterion is completely untenable when it comes to disk brakes, where the rotating disk is clamped between two comparatively small spots of lining material.

A better generalization, many contend, is a rating based on swept area (area of the drum or disk that the lining comes in contact with).

Brake-operating mechanisms have not changed basically for the last 25 or 30 years. Most makers use a self-energizing type that borrows energy from the forward motion of the car to supply a big part of the braking effort.

A wedging action of the primary shoe against the drum develops a force that is transmitted to the secondary shoe through a linkage. The secondary shoe actually furnishes between 75 and 80 percent of the total braking effort. The linings for the two shoes must have different characteristics to insure equal wear and consistent operation.

Consistency, just about the most important aspect of brake behavior, has been much improved recently. This has been done by careful tailoring of linings to give uniform friction under varying conditions, and by minor juggling of linkage geometry for precise control of the self-energizing action.

Last year Mercury and Edsel added a clever device that automatically adjusts for lining wear when the car is braked while moving in reverse. Ford Motor designers have been so pleased with the improved consistency that they have added this feature to the Lincoln for '59.

Chrysler is the dissenter on self-energizing brakes. While they do actually get some servo action from the wrapping effect, they prefer to use individual actuating cylinders for each shoe in their front wheels rather than multiply the self-energizing force by a linkage.

Power brakes are popular, but they don't solve basic braking problems. They won't stop you any quicker, nor help one whit when your brakes fade away on a long downhill run. They simply let you stop by tipping your toe into the brake

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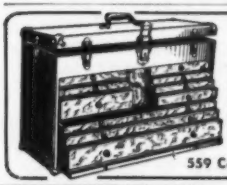

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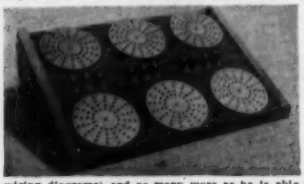

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***The Baffling Problem of Brake Fade***

pedal instead of using your leg muscle.

***What's ahead?*** Every engineer I talked to agreed on one point: Drum brakes will still be around for a long time. Those wonderful disk brakes, which the self-styled experts keep heralding, aren't a panacea. With disks you simply exchange one set of problems for another. Just about every advanced-design engineering section in Detroit has been working with disks. Opinions so far: fine for sports cars and airplanes where they are used by pros who don't mind roughness, noise and frequent maintenance, but at their present state of development, the average American car buyer would yell his head off if he had to put up with them.

Forced cooling is also getting attention. Efforts have ranged all the way from wheel covers with turbine-like blades to elaborate systems for circulating liquid coolant through hollow brake shoes. All efforts of the former type have fallen short of success simply because car wheels don't turn fast enough to get much fan action. The liquid-cooling schemes usually involve using the brake lining in the drum with hollow iron shoes rubbing against it. So far, results have not been encouraging.

***Brake governors?*** Controversial even among engineers working for the same outfit, these gadgets automatically ease brake application on individual wheels when they start to lock. The idea behind them is to provide maximum stopping ability automatically by allowing peak brake application just short of causing skid. There is plenty of evidence that this dingus is being actively developed in Detroit, but those concerned are being close-mouthed about details. However, full reports are available on tests run in England on such a device and it has shown up on GM's dream car, Firebird III.

Engineers from two different companies told me that, in their opinion, the next notch upward in brake capacity when it is needed will come from integrally cast aluminum-alloy drums and wheels. They believe that this big jump in heat capacity and effective cooling surface will take care of their needs for the foreseeable future. END

***Next Month: How to be a smart buyer when you need a brake-repair job.***

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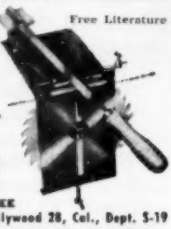

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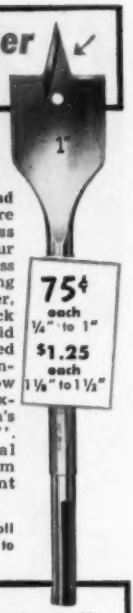


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***Sizing Up the New Wagons***
[*Continued from page 88*]

stores it under the fender behind the right rear wheel. Ford stores it under the floor. Chevrolet stores it under the floor in its six-passenger versions, but in its nine-passenger wagons, you find it upright on the starboard side at the rear.

"See?" say the Ford people looking at Chevrolet. "That's what comes of facing that third seat south—no room under the floor for the tire."

"See?" say the Chevrolet people looking at Ford's partly storable seat. "That comes of making the seat face north."

"See?" chorus the Ford and Chevrolet people, looking at Plymouth's spare. "It's all dirty. That's what comes of carrying it exposed like that."

Four-door, sedan-like wagons will continue to grow in popularity. The two-door wagon used to be the industry's standby. (The manufacturers rationalized the design by saying, "No rear doors for the kids to fall out of.") Now Chevy has only one two-door model left in its line as against three flavors in its more popular four-doors. Plymouth sold more four-doors than two-doors in '58. Ford was an exception.

***The sales curve.*** Wagons will continue to grow in popularity, period. Edward N. Cole, Chevy's general manager, estimates that it won't be long before every fifth, or even every fourth, car off the industry's production lines will be a station wagon. *In 1958, Plymouth's wagons outsold its most popular sedan.* Better than one car out of every four produced by Plymouth was a wagon. For the current model year, Plymouth is prepared to devote *40 percent* of its facilities to wagons.

***Prices.*** You guessed it. They're up again. As a buying guide, here are comparisons between the lowest-priced sedans and the lowest-priced wagons put out by Chevy, Ford and Plymouth, including the federal excise tax and dealer handling but no freight or other taxes:

| | *Sedan* | *Wagon* |
|---|---|---|
| Chevrolet | $2,160 | $2,571 |
| Ford | 2,132 | 2,567 |
| Plymouth | 2,192 | 2,534 |

Those are pretty bare wagons. If you bulge with coarse-denomination currency, you can pay more than $4,000 for, say, the snobbiest Plymouth wagon fitted out with all the options. END

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Another new unit is the Miller Electric Rodder which has patented cutters that expand automatically to the size of the pipe. It will clean out heavy obstructions in pipe diameters 3" to 12". Smaller Sizes available. But now, what are these Tools worth in **COSTLY PLUMBING BILLS SAVED.** Tear this Ad out—and write your name and address beside it for **FREE BOOKLET** on Hand and Electric Units. Obey that urge. No Agent will call. A post-card will do (Chicago Phone Kildare 5-1702)

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**FREE** Saw Set with Initial Order

**QUICK WAY SAW CO.,** 134 Tompkins Street, Cortland, N.Y.


### *Boosting Your Output of Good Ideas*
[*Continued from page 129*]

ner for dessert. A more prosaic example is the bicycle repairman who got publicity and doubled his business by staging races for the kids.

Down-to-earth ideas about solving common problems can be very effective. So can fanciful ones like edible dishes. You won't know until you try them. And you can't try them until you force your brain to produce them. That's the important thing to remember.

You can set up brainstorming sessions where you work. Or set them up with the men in your car pool, your wife or your neighbors, to tackle everything from boosting your neighborhood to winning suggestion-box awards.

The best brainstorming group includes people with different personalities and backgrounds. If possible, bring in somebody who doesn't know anything about the problem at hand—your wife, for example, on a semitechnical or business problem.

She probably won't know certain things are impossible, so she'll suggest them—and maybe they'll turn out to be possible after all.

You can brainstorm by yourself. Groups produce the most ideas, simply because more creative heads are at work. But according to some researchers, you yourself will create more and better ideas when you are alone. Yale University Prof. Donald W. Taylor found that lone thinkers turned up twice as many ideas *per person* as people in groups. What's more, the individuals' ideas were as original and useful as the groups'.

Another kind of idea-getting system, first developed at Hotpoint Co., is called "reverse brainstorming." In this system, criticism isn't ruled out; it's emphasized. The idea is to look at something long and hard, then list as many things as you can think of that are wrong with it—including wild and ridiculous criticisms.

For instance, suppose you figure you can make some money by inventing something—an improved bicycle, say. Go out in the garage, sit down and ponder your son's bike. Search out every detail that might possibly cause trouble. Follow the usual brainstorm rules: quota, deadline, no judgment of ideas. Very possibly you'll come up with an idea for improving the

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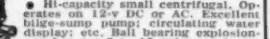

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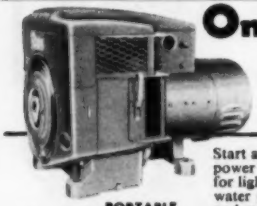

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bike—something that was blocked in other minds.

Still another system was developed at MIT by Prof. John E. Arnold. Its main purpose is to get you into the habit of thinking along untried, unorthodox paths.

Arnold told his industrial-design students to imagine a planet named Arcturus IV. This planet has a gravity 11 times Earth's, a methane atmosphere, ammonia seas. Its inhabitants are man-like creatures with two Earth-type eyes and one X-ray eye, three-fingered hands, fragile bones, and so little dexterity that they'd kill themselves in minutes if handed the wheel of your car. Arnold's students were assigned the job of designing products to sell on Arcturus IV.

This kind of exercise gets you used to traveling in totally new regions of thought. Paradoxically, that's where you'll often find the best ideas. END

***This is the fifth article in a series on the Science of Personal Success. The next will appear in an early issue.***

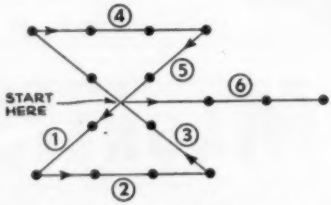
**Solutions to Mental-Block Problems**

1 Fill the three-quart bucket with water from the six. Then hold the three over the six. Sink the two-quart bucket to its brim in the three. Two quarts of water will be displaced from the three, leaving one quart.

2

(Note: These are sample solutions. Others are possible.)

3




Sure, you have to move the pencil six times. But the requirement was for five straight lines. You were forbidden to backtrack or lift your pencil, but there was no rule against drawing a line in two segments.

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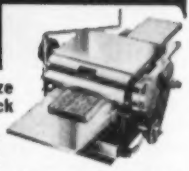

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In case after case, while gently relieving pain, actual reduction (shrinkage) took place.

Most amazing of all—results were so thorough that sufferers made astonishing statements like "Piles have ceased to be a problem!"

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This substance is now available in *suppository* or *ointment form* under the name *Preparation H.** Ask for it at all drug counters—money back guarantee. *Reg. U.S. Pat. Off.

**New Cat Tractor**
[*Continued from page 147*]

fatigue resistance). Con rods were redesigned around the big end to carry the 30-percent higher gas pressures of the turbocharged engine. Fatigue resistance of the aluminum bearings was raised with steel backings. Oval pistons (long used in auto engines to counteract stress distortion) make a first appearance in D8s.

***An integrated hydraulic system*** feeds the steering clutches, brakes and transmission from a common sump, filter and pump. The hydraulic controls make the big machine a pleasure to drive. More important, they reduce operator fatigue—no small factor, since as many as 95 starts and stops have been clocked in just eight minutes of tractor operation.

The Caterpillar oil clutch is actually a disk type, with sintered-bronze pressure facings. A continuous flow of oil through the plates lubricates and cools them, giving long life to one of the most overworked units in any crawler. A hydraulic booster goes into action automatically to engage or disengage the clutch.

I tried the controls with the hydraulic system dead. The clutch lever took most of my strength to latch over. The brake pedals felt rock solid.

As in other crawler tractors, the two track frames pivot on the centerline of the drive sprockets, letting the front ends "walk" up and down over rough ground. Some chassis weight rests on an equalizer bar set crosswise at the middle of the machine and mounted in rubber.

Made with either torque-converter drive or conventional transmission, the D8 has double instead of single reduction in the final drive to the track sprockets. Ground pressure on the 24-inch-wide track shoes is only 9¼ pounds per square inch—not very much more than on your own feet. (If you weigh 180 pounds, you load one shoe sole about seven p.s.i.)

Computers did their share in planning the new machine. Calculating loads on con rods at various engine speeds, a job that would take a mathematician months, can be done in a few hours. The action of a new valve train can be set up experimentally on the computers before a piece of metal is shaped.

"Some day," said Tom Geselbracht, "we may be able to compute a whole earth-moving job on these machines." END

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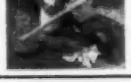

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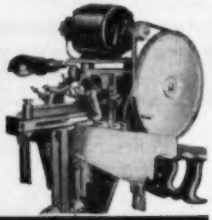

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**Babies to Order**
[*Continued from page 152*]

but only so far as the paper's circulation was concerned.

In theory, however, something of this sort might be possible. The difference in electrical properties on the sperm surface should produce slight differences in chemical behavior. In fact, Dr. Shreder claimed that by intramuscular injection of separated sperm into rabbits she could produce antibodies against X-carrying sperm or Y-carrying sperm at will, and that a female rabbit with antibodies against one type of sperm could be made pregnant only by the other type. In this way she claimed to control sex without artificial insemination. No one has yet confirmed this. Both Dr. Gordon and Dr. Lewin expect, however, that within a few years some method for sex control without artificial insemination will be worked out.

One exciting possibility of sex control is to wipe out hereditary defects, such as the dread bleeding disease hemophilia, that are transmitted by the X chromosome.

***Birth control.*** Finally we come to the third part of the problem, birth control. Like control of sex, this is an old interest of the human race that can be traced back to the ancient Egyptians. But now it is swiftly assuming new importance because a "population explosion"—brought on through medical and public-health advances—threatens increasing food shortages in many parts of the world. World population, now more than 2.5 billion, is increasing at the staggering rate of about 35 million a year. Some countries may double their population in the next 30 years. World food production is increasing at a much slower rate.

Birth-control methods now available are quite reliable when used by educated, conscientious couples with access to medical advice. But they are not very satisfactory for the poorly educated masses of impoverished nations like India or Indonesia. Methods much simpler and more acceptable to social customs around the world have long been sought. That's one main reason why there's been intense interest in the recent work of Dr. Gregory Pincus of Worcester, Mass., and Dr. John Rock of Boston to develop a "contraceptive pill."

***How the new pills work.*** The pills

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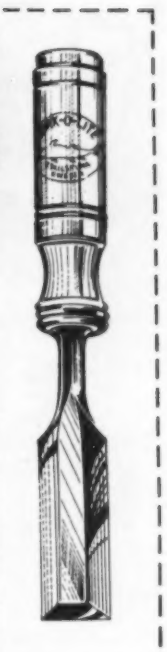

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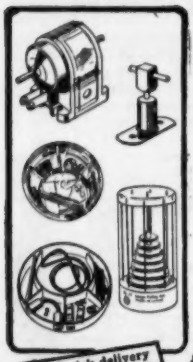

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contain progestins, compounds acting like the ovarian hormone progesterone, which is normally secreted during the second half of each menstrual cycle. The progestin pills, like natural progesterone, suppress ovulation. If no egg is released, a woman can't become pregnant. To use the pills, a woman simply takes one a day for 20 days during each menstrual cycle, starting on day five (counting the first day of menstruation as day one). The last pill is taken on day 24, and usually she menstruates three or four days later. During the entire cycle she is non-fertile.

How effective are the pills in preventing pregnancy? At present there are conflicting reports. An experiment in Puerto Rico with about 300 women showed amazingly high reliability, with no pregnancies during two years among those taking the pills exactly as directed. (There were a few pregnancies among women who skipped an occasional pill.)

A later study in Los Angeles gave somewhat less striking results. Even so, the findings are significant.

What about harmful side effects? So far there is no definite sign of anything serious, though some women experience nausea or headache. Women who have stopped the treatment have quickly demonstrated that there's no permanent decrease in fertility. If anything, in fact, the pills have the opposite effect. Taking progestins for a few months seems to help in some types of sterility.

The procedure is still quite new, however, and many doctors fear that harmful effects may appear if progestins are taken regularly for several years. Here's what one leading authority, Dr. Allan Barnes, Chairman of the Department of Obstetrics and Gynecology of Western Reserve University, has said: "I have asked many of my friends in physiology whether they would put their wives on such a steroid pill for any length of time—if their wives were 22 years old, say, and still wanted a family in the future. I have yet to find one who would."

Pharmaceutical firms are cautious as a result, and the pills are available on prescription only.

No matter how effective these pills eventually turn out to be, they aren't an answer to the world population problem. One important drawback is expense;

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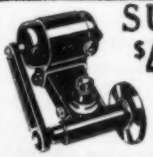

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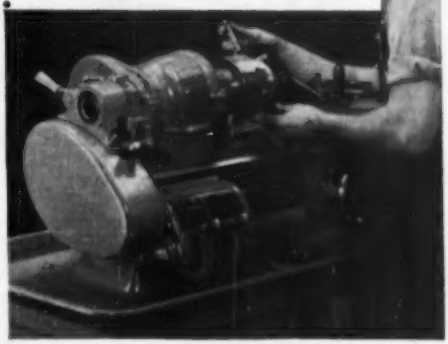

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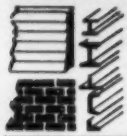

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treatment now costs about $10 a month. Also, the need for taking a pill every day 20 days in a row is a drawback for widespread use. Something that could be taken once each menstrual cycle would be much more acceptable.

***The outlook.*** So a great many other approaches are now under investigation, and researchers expect major advances within the next few years. The reason why expectations are so high is the same reason that makes the sterility problem so tough: the many links in the chain. In birth control, instead of having to keep the whole chain in repair, the problem is merely to break any single link.

Dr. Abraham Stone, world-famous authority on birth control, has listed the three most important areas of present research effort:

1. Improved chemical sperm-killing preparations for vaginal use.
2. Better preparations to be taken by mouth, or injected intramuscularly.
3. Improvement in the rhythm or "safe period" method.

This last is of particular interest because it is the only birth-control method approved by the Roman Catholic Church. The "safe period" is based on the linked facts that sperms ordinarily die within two days if they do not reach an egg; eggs die within a day or two after ovulation if not fertilized. Pregnancy is thus highly improbable if there are no sexual relations for a period covering two days before ovulation to two days after.

One problem is to know when ovulation is going to occur. Usually it comes on the 14th, 15th, or 16th day before the start of the next menstrual period, but it may occur in almost any part of the cycle. So what researchers seek is a simple, inexpensive test by which a woman can tell two days ahead of time when she is going to ovulate; or a hormone treatment to make the menstrual cycle more regular.

In short, in the age-old problems of human reproduction, science is advancing with the same astonishing swiftness as in rocketry and atomic energy. And though biochemistry and physiology aren't as spectacular as an A-bomb test or a moon shot, they may prove a great deal more significant for the future of the human race. END

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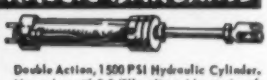

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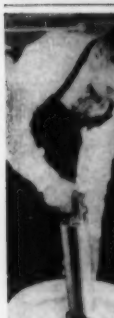

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## How Nautilus Hit the Bull's-Eye

[Continued from page 164]

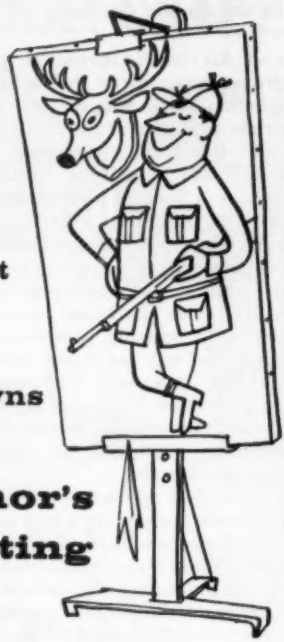
this several times, and proved its inertial navigator to be true, but such opportunities could not be counted on.)

***Half a world away.*** On the other hand, there was no likelihood that the inertial navigator would be perplexed about its position. Apart from the fact that it was immune to the wiles of magnetism, it was navigating, literally—as if it were half a world away. For the special purpose of transpolar voyages, the N6A was set up to navigate by a unique grid of geographical coordinates, twisted 90 degrees from the normal. On this imaginary grid, latitudes and longitudes changed places. In the mind's eye of the N6A, the equator ran through the poles, and a line connecting the poles lay on the old equator.

This arbitrary arrangement was made because there is never any doubt about the direction of east and west at the equator, whereas longitude shrinks to zero at the poles. It made no difference to the inertial navigator, which uses no compass anyway.

***Wandering gyroscopes.*** The Nautilus crew celebrated with solemn dignity its momentous arrival at the topmost point on earth, and then the sub moved confidently on to open water on the other side of the world. When it got there, after traveling 1,830 miles and 96 hours submerged, it was only a few miles away from its precise destination. It might have hit the spot on the nose if gyroscopes, even the best of them, didn't wander slightly during a period of days. By riding on an incredibly thin layer of gas instead of orthodox bearings, they can be held in place even more rigidly. Autonetics has been experimenting successfully with this technique, and it will be used on navigators in future missile subs.

With an inertial navigator aboard, no ship need ever get lost, no matter how long storms hide sky and shore or even if its radio fades and dies. And if scientists are correct in predicting that there will some day be submarine tankers and freighters, inertial navigators will doubtless guide them all. For no other kind of navigation is accurate near the North Pole, and that's the shortest route for many journeys—6,000 miles shorter, for instance, than the present sea lanes between Tokyo and London. END



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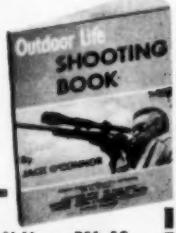


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[Continued from page 120]

ic bomb. Early in 1941, leading fluorine chemists were called in to find a way around a formidable roadblock in the atomic program.

Here was the problem: To make the bomb, the fissionable uranium-235 had to be separated from the much more plentiful U-238, and plans were drawn up for a "gaseous-diffusion plant." This called for combining the metal with fluorine, creating a gas from which the U-235 could be gradually "strained" by passing it through thousands of special filters. More thousands of leakproof pumps and valves would be needed, but all known gaskets, seals and lube oils would melt before the wild fluorine compound. The fluorine experts had the answer: Fluorine could be caged only by another compound of fluorine itself.

***First, a half-thimbleful.*** Dr. Joseph H. Simons, of Pennsylvania State College, a brilliant pioneer in fluorine chemistry, was known to have made a small vial of the needed compound. From him, the Columbia team got a precious half-thimbleful of clear liquid which they code-named "Joe's Stuff" for security reasons. It was tested, and it worked.

But tons of the stuff, in liquid and solid form, were needed if the diffusion plant were to work. First, more was needed for testing. So the handful of scientists turned a laboratory in Havemeyer Hall into a small pilot plant to make a batch of the plastic. It was highly hazardous; fires were routine. More space was obtained, and in a few months about 100 pounds were made. Further tests checked out, and the task of making the material in bulk was turned over to several companies.

Today, three big gaseous-diffusion plants, one of the greatest engineering triumphs of history, turn out most of the free world's enriched uranium, used both in weapons and in the new atomic power plants. Thousands of fluorocarbon parts make this possible.

Dr. Simons went on to invent a new electrolytic process, which works something like a storage battery, for making the new plastics material. It is a tall tank with two entrance pipes. Through one flows a hydrocarbon—perhaps a lube oil—to be converted into the new material. Through the other comes a fluorine compound. An electric current strips the weak hydrogen atoms from the oil and puts the tough fluorine atoms in their place. The fluorine atoms form an impregnable wall around the molecule, giving it superior strength. 3M bought the Simons patents, and built a plant in which scores of the tanks turn out fluorocarbons.

Like all new chemicals, fluorocarbons are expensive. But raw materials are cheap and plentiful, and experts agree that they should follow the usual trend of lower prices with greater production volume, opening the way for much wider use. Du Pont has increased Teflon production eight-fold since 1950, and is now increasing plant capacity to double today's production by 1960. 3M has equipment to double production.

***Future full of fluorocarbons?*** Fluorocarbons are not merely a new plastic; they are a whole new field of chemistry with infinite ramifications and possibilities. For each of the many thousands of hydrocarbon products on the market—including petroleum and coal products, plastics, natural and synthetic rubbers, drugs, dyes, explosives, paints, varnishes and insecticides—hundreds of fluorocarbons can be made by substituting fluorine atoms for all or some of their hydrogen atoms. It would take a hundred chemists a century to make a fair start on the job.

Dr. Simons, who is continuing his fluorine research at the University of Florida, likes to speculate on the great future of his favorite element. He foresees fluorocarbon wall coatings—paper, paint or varnish—that will resist fire, vermin, dirt and fading; long-lasting, non-oxidizing outdoor house paint in any color; a sealed automobile engine with permanent fluorocarbon oil; a permanent liquid for the cooling system that will not freeze or rust the radiator, and 100,000-mile tires made of fluorocarbon rubber. Scientists have only begun to consider the physiological and biological uses, he says, and some day we may have a battery of fluorocarbon drugs with unique therapeutic properties. Among the millions of untried combinations that lure the research chemist, many will have no immediate use, but it is as certain as tomorrow's sunrise that somewhere in the lot, priceless new bonanzas await the pioneer. END

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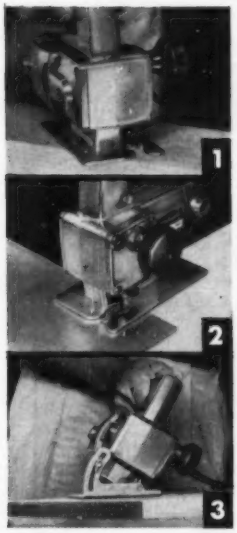

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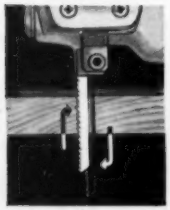

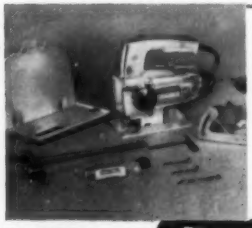

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# Over and over again — It's the same old story...

## *Finally a formula that really works*

*A dramatization posed by professional model.*

### *I was ashamed to always be so tired!*

I ALWAYS felt simply "run down". People were thinking of me as a "spoil-sport". I didn't know why until my doctor explained why I felt "tired". . . . why my vigor was slipping away . . . why my wife and family were beginning to think of me as a worn-out man. He told me how a vitamin-mineral deficiency in my diet could rob me of the joys of living . . . and suggested that I supplement my diet with pep-building vitamins and minerals.

Well, I put off doing anything about my condition — until one day I sent for a 30-day FREE supply of high-potency Vitasafe C. F. Capsules and began taking one Capsule a day. In a short time, I began to feel like a new man! My pep and vigor increased, I continued with the Vitasafe Plan — and I felt stronger, more energetic!

Today, no one thinks of me as a "worn out old man". I've got pep and energy to burn, and I have fun like a fellow half my age! *And you may too!* Why don't you take advantage of this sensational free offer to see for yourself whether you, too, can again feel peppy and full of life! Mail the postcard *today* and accept this no risk offer as I did.

### *Our fights have turned to kisses!*

IT'S hard to believe that my wife and I used to fight. She would start nagging at me the minute I got home from work —dead tired—and I would snap right back at her! We argued and bickered so often that we suddenly realized our marriage was breaking up! There wasn't any real reason for it except that both of us felt so tired all the time that we got on each other's nerves.

Our family doctor gave us some advice that probably saved our marriage. Many people, he told us, may become worn-out, tense and short-tempered because their diets do not contain enough vitamins, minerals and lipotropic factors. To correct this condition, each of us started taking Vitasafe High-Potency Capsules—just one a day. It wasn't too long until we had more pep, more energy—and our dispositions improved. Instead of fighting, we were back in each other's arms—just as we were on our honeymoon.

If you or your wife—or some other member of your family—have lost the pep and energy you used to have, you owe it to yourself to try proven Vitasafe High-Potency Capsules for 30 days at our expense and judge the results for yourself!

*A dramatization posed by professional models.*

**EACH DAILY VITASAFE CAPSULE FOR MEN CONTAINS**

| | | | |
|---|---|---|---|
| Choline Bitartrate | 31.4 mg. | Niacin Amide | 40 mg. |
| Inositol | 15 mg. | Calcium Pantothenate | 4 mg. |
| dl-Methionine | 10 mg. | Vitamin E | 2 I.U. |
| Glutamic Acid | 50 mg. | Folic Acid | 0.5 mg. |
| Lemon Bioflavonoid Complex | 5 mg. | Calcium | 75 mg. |
| Vitamin A | 12,500 USP Units | Phosphorus | 58 mg. |
| Vitamin D | 1,000 USP Units | Iron | 30 mg. |
| Vitamin C | 75 mg. | Cobalt | 0.01 mg. |
| Vitamin $B_1$ | 5 mg. | Copper | 0.45 mg. |
| Vitamin $B_2$ | 2.5 mg. | Manganese | 0.5 mg. |
| Vitamin $B_6$ | 0.5 mg. | Molybdenum | 0.1 mg. |
| Vitamin $B_{12}$ | 2 mcg. | Iodine | 0.075 mg. |
| | | Potassium | 2 mg. |
| | | Zinc | 0.5 mg. |
| | | Magnesium | 3 mg. |

**We invite you to compare the richness of this formula with any other vitamin and mineral preparation.**

**SPECIAL PLAN FOR WOMEN ALSO AVAILABLE. CHECK POSTCARD IF DESIRED.**

# FREE 30 DAYS SUPPLY High-Potency Capsules

**LIPOTROPIC FACTORS, MINERALS and VITAMINS**

**Safe nutritional formula containing 27 proven ingredients: Glutamic Acid, Choline, Inositol, Methionine, Citrus Bioflavonoid, 11 Vitamins plus 11 Minerals**

To prove to you the remarkable advantages of the Vitasafe Plan . . . we will send you, without charge, a 30-day free supply of high-potency VITASAFE C.F. CAPSULES so you can discover for yourself how much stronger, happier and peppier you may feel after a few days' trial! Just one of these capsules each day supplies your body with over *twice* the minimum adult daily requirement of Vitamins A, C, and D – *five times* the minimum adult daily requirement of Vitamin B-1, and the *full* concentration recommended by the Food and Nutrition Board of the National Research Council for the other four important vitamins! Each capsule contains the amazing Vitamin B-12, a remarkable nutrient that helps nourish your body organs. Vitasafe Capsules also contain Glutamic Acid, an important protein derived from natural wheat gluten. And now, to top off this exclusive formula, each capsule also brings you an important dosage of Citrus Bioflavonoid. This formula is so complete it is available nowhere else *at this price!*

POTENCY AND PURITY GUARANTEED

You can use these Capsules confidently because U. S. Government regulations demand that you get exactly what the label states – pure safe ingredients. The beneficial effects have been proven time and time again!

WHY WE WANT YOU TO TRY A 30-DAY SUPPLY – FREE!

So many persons have already tried VITASAFE C.F. CAPSULES with such outstanding results . . . so many people have written in telling us how much better they felt after only a short trial . . . that we are absolutely convinced that you, too, may experience the same feeling of improved health and well-being after a similar trial. In fact, we're so convinced that we're willing to back up our convictions with our own money. *You* don't spend a penny for the vitamins! All the cost and risk are *ours.*

AMAZING PLAN SLASHES VITAMIN PRICES ALMOST IN HALF

With your free vitamins you will also receive complete details regarding the benefits of an amazing new Plan that provides you regularly with all the factory-fresh vitamins and minerals you will need. *You are under no obligation to buy anything!* If after taking your free Capsules for three weeks you are not entirely satisfied, simply return the handy postcard that comes with your free supply and that will end the matter. Otherwise it's up to us—you don't have to do a thing—and we will see that you get your monthly supplies of capsules *on time* for as long as you wish, at the low money-saving price of only $2.78 per month (plus a few cents shipping) – *a saving of 45%*. Mail the postage-free postcard now!

*Mail Postcard To* VITASAFE CORP., 43 W. 61 St., N.Y. 23, N.Y.

or when in New York visit the VITASAFE PHARMACY, 1860 Broadway at Columbus Circle

IN CANADA: 394 Symington Ave., Toronto 9, Ontario

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H-30

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**[Canadian formula adjusted to local conditions.]**

*Do You Wonder What Makes You*

# SO DARN TIRED?

I used to feel weak and run-down all day long — from morning 'til bedtime. I found myself getting upset by almost everything. I was "touchy" at the office, cross and irritable with the children. I'd start arguments with my wife over the smallest things. I finally decided to see our doctor.

*A dramatization posed by professional model.*

After examining me, the doctor explained that my condition was due to a lack of important vitamins and minerals in my diet. He recommended I take a good food supplement daily.

I sent away for a trial supply of Vitasafe High-Potency Capsules that I had seen advertised. Soon my energy came back, and now I feel like a new man! If you feel tired, nervous and miserable, why not send for your trial supply by mailing the postcard today?

**MAIL POSTCARD TODAY FOR FREE 30-DAY SUPPLY OF VITAMINS**

Postage Will be Paid by Addressee

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